SCHOLASTIC COACH

FEBRUARY 1935 25c

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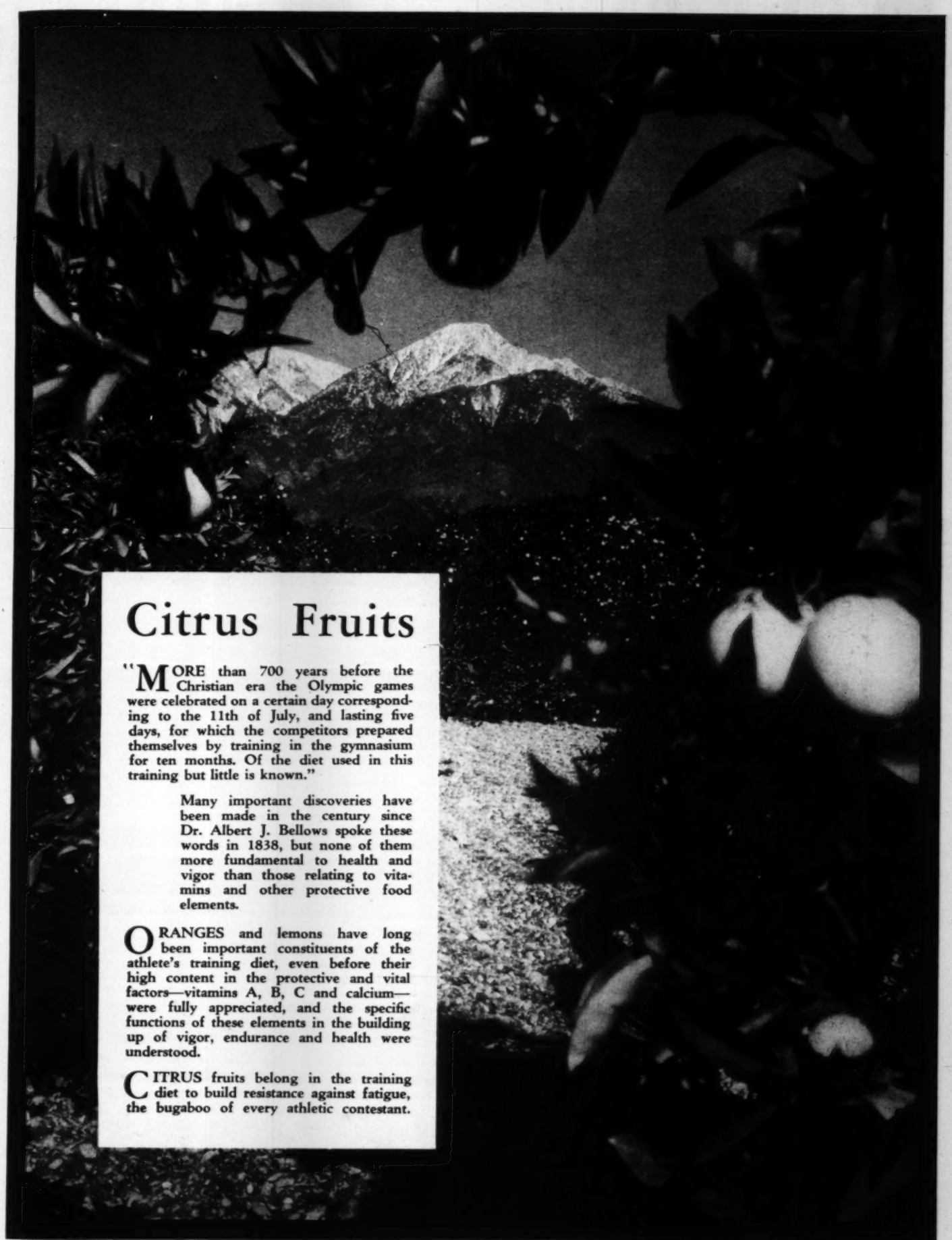
BASEBALL EQUIPMENT



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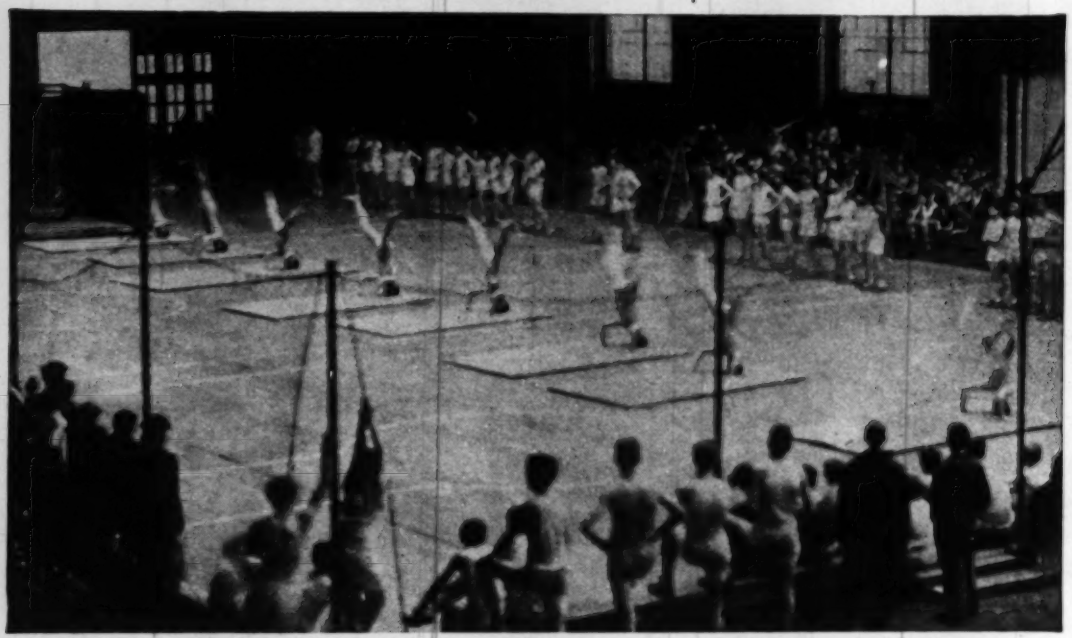

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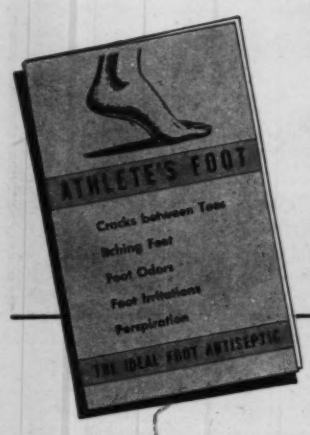

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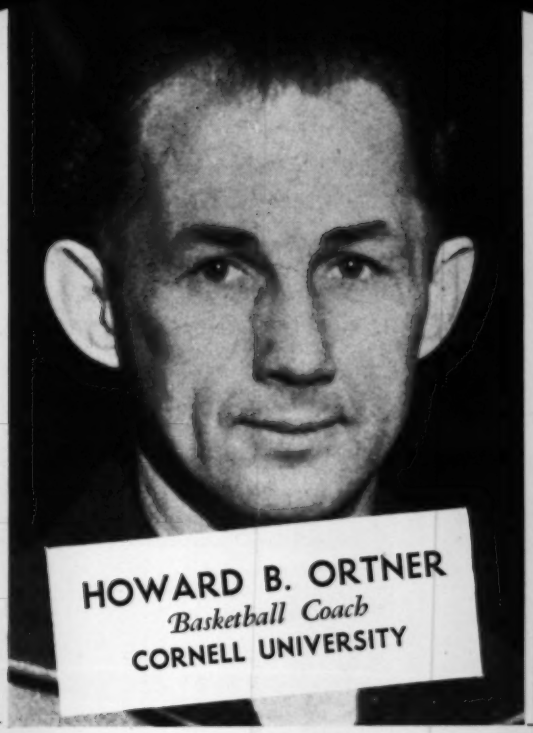


HOWARD B. ORTNER
Basketball Coach
CORNELL UNIVERSITY

COACH ORTNER'S RULES FOR FIRST AID IN ATHLETICS

1. Keep blisters clean and covered with a bandage; floor burns should be washed with soap and water when the shower is taken, and then apply a soothing antiseptic.

2. If afflicted with a severe cold, do not over-exercise. Marked loss of weight and over-strain of the heart may result from practise while suffering from a cold.

3. Wear equipment that affords maximum protection.

4. See a doctor as quickly as possible after an injury.

5. Check your weight daily during heavy exercise periods. If you find you are not regaining lost weight quickly, let up on the amount of work you are doing, get more rest and add to your diet.

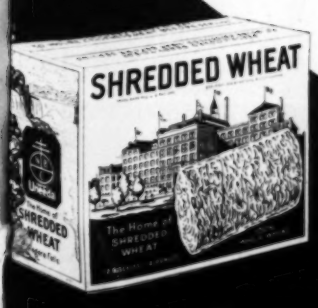
6. Take your shower correctly; moderately warm water at first for cleansing and then taper it off with cool water.

7. Get plenty of rest; sleep 8 to 10 hours each night.

8. For energy, eat whole grain cereals, starches, sugars, butter, etc. Drink plenty of liquids—avoid rich sweets. Before exercise, eat only light, easily-digested food.

9. Start exercising slowly. Build your resistance to heavy work periods through slow conditioning.

10. Start each day's exercise with a warm-up period. This raises the temperature of the muscles and increases your efficiency.



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NATIONAL BISCUIT COMPANY

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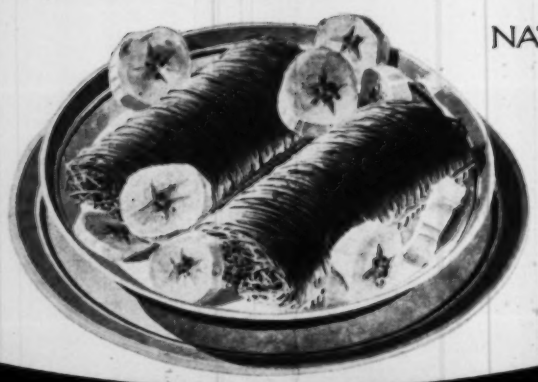

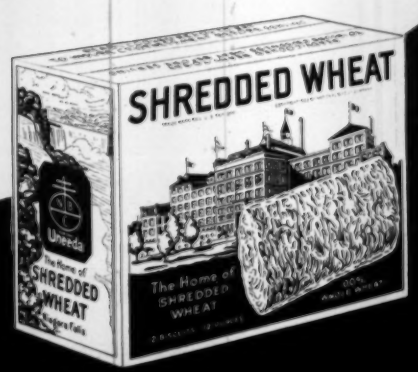

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SCHOLASTIC COACH

Reg. U.S. Pat. Off.

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JACK LIPPERT, Editor OWEN REED, Associate Editor

The editor will be glad to consider any manuscripts and photographs submitted to him for publication, if accompanied by stamped addressed envelope for return, if unsuitable.

Scholastic Coach is issued monthly nine times during the academic year (September through May) by Scholastic Corporation, M. R. Robinson, president. Publishers of *Scholastic*, national high school classroom weekly.

Address all editorial and advertising communications to Scholastic Coach, 250 E. 43rd Street, New York, N. Y.

G. Herbert McCracken, publisher; S. Z. Oppenheim, advertising manager. Western advertising manager, R. E. Hutchison, 35 East Wacker Drive, Chicago, Ill.

Subscriptions for the United States, $1.50 a year. Canada and other foreign, $2. All correspondence concerning subscriptions and circulation should be addressed to Circulation Department, Chamber of Commerce Bldg., Pittsburgh, Penna.

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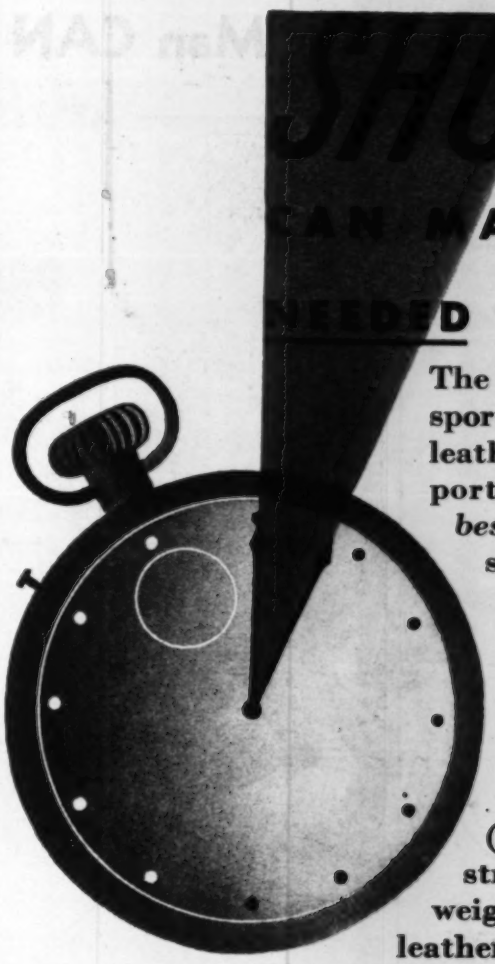

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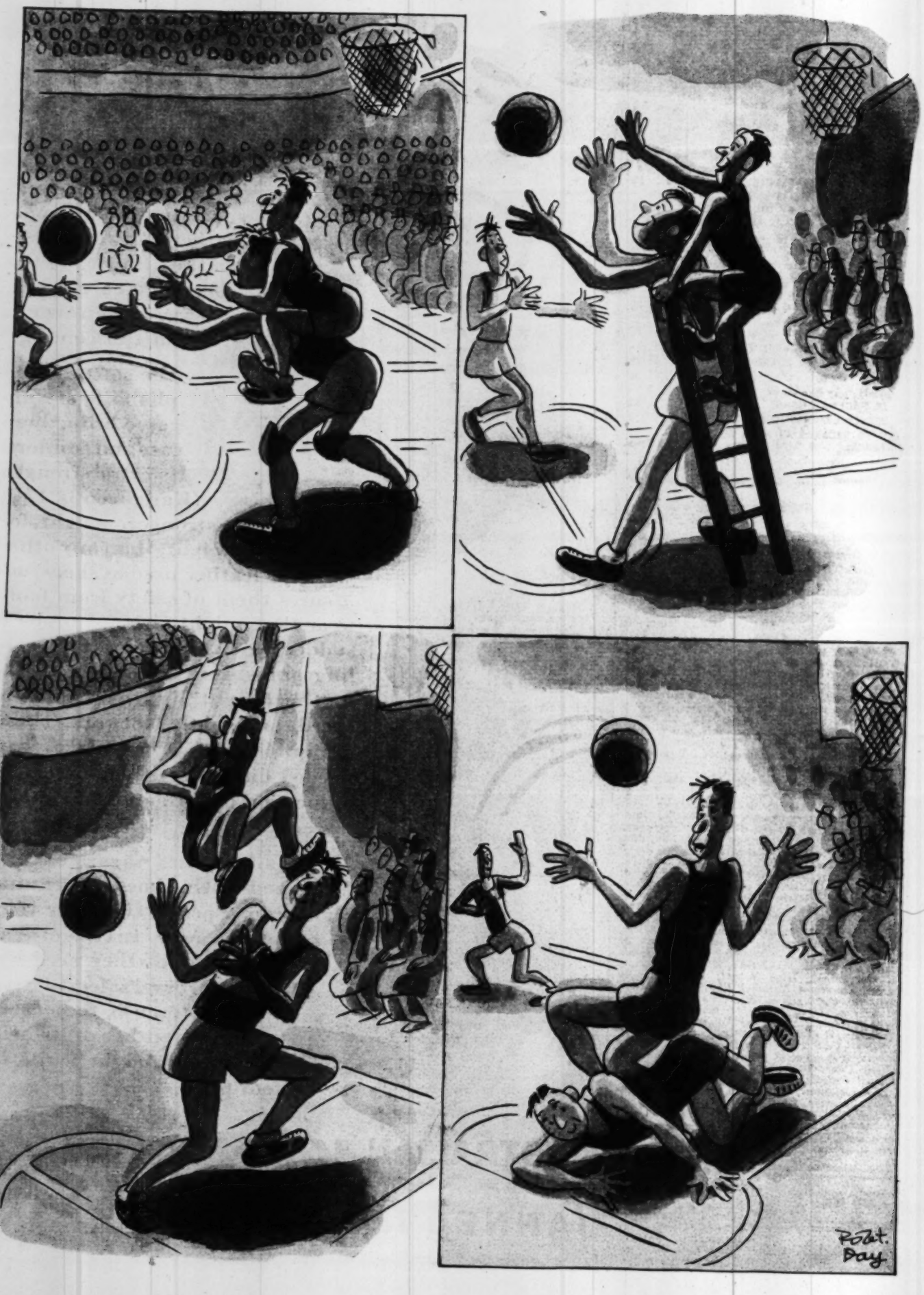
Make sure your varsities are equipped with shoes of genuine Kangaroo. Specify them for your scrub and intra-mural teams, too—they need the comfort and safety of Kangaroo, even if they can't take advantage of its help in speed and in feints of foot play.

AUSTRALIAN KANGAROO TANNED IN AMERICA

The Pivot Man CAN Be Guarded



HERE BELOW

The life of a pivot man is not a merry one. Three cheers and five pacifiers for publicity. Dr. Carlson's Pitt team plays Figure 8 marbles.

WE don't know what kind of treatment is accorded the pivot player (man in the bucket) in other parts of the country, but around our way the defense has been giving him the works. From the point of view of justice, rather than legality, the defense has a good case. A first class pivot man—one of those tall, strapping and stretching fellows who can shoot off either foot with either hand—is practically impossible to guard successfully. So, if the defense is to stop him they must resort to means extraordinary, come what may. On the opposite page Robt. Day, inspired by some of the basketball he recently saw around New York, offers a few suggestions for putting a crimp in the pivot man's style.

Not only is the defense out gunning for the pivot man these days, but many of the sideline basketball experts are determined to take the pivot out of him or do something to him through rules changes to render him less potent. At any rate, the sides are lining up, and if you feel strongly one way or the other—for or against the center jump and for or against the pivot man—speak up and throw the weight of your opinion into this raging controversy.

Among the coaches from South and West who brought their basketball teams to New York this season* and departed wishing they had provided their pivot men with suits of armor was Adolph Rupp, University of Kentucky coach, a product of Phog Allen basketball. Coach Rupp was so provoked over the New York interpretation of the extent to which the defense may go in guarding the pivot player that he caused no little excitement by the frankness of his criticism in the newspapers. A great team, Kentucky lost by one point and several dozen half-Nelsons to the best team east of Pittsburgh, south of Syracuse and north of Lexington, Ky.—New York University. The New York team could not stop the Kentucky pivot man without keeping "in close touch with him," which is putting it mildly. You know the old trick of draping yourself all over the pivot man until he gets madder than a hatter and neglects to play basketball in his desire for revenge and some slight degree of freedom.

The pivot play can be kept clean by officials who are quick to call a foul on the player responsible for the personal contact — either the pivot man or his guard—especially during the time when the pivot man does not have the ball.

Keeping the pivot play clean in this way means that the offense, particularly when they have a first class pivot man, is favored at the expense of the defense. Well, why not? We believe that the game is at that stage of evolution where the offense can use a few more favors to good advantage. In the case of the pivot play it may not be justice for the defense but it is justice for basketball.

*College basketball in New York, now on a big-time basis, is being staged in Madison Square Garden. The Garden has a basketball promoter who books leading out-of-town teams to meet New York college teams in double-headers. The Garden has been packed on every occasion, no less than 16,000 persons attending each event, world's record basketball crowds.

Title Yell

ON this page two months ago we presented a selection of yells from high school students throughout the country and cited one in particular which seemed outstanding to our rather warped taste. Its theme, "swell those tiny gate receipts," was indeed refreshing after the blood and sadism spilled by most of the adolescent writers. Not that we want to repress the boys and girls who really feel the necessity for this verbal destruction which they hurl at rival teams and schools. For every opponent they drag through the valley of death in verse there may be any number of complexes they spare themselves. We don't know. All we know is that when it comes to yells we like Life not Death.

The Raub, Indiana, High School girl, whose yell won our unstinted praise, now has a rival to challenge her supremacy as the Yeller Laureate of the United States. This rival is a post-graduate of at least some thirty years standing, and is a professional poet besides, and so, no doubt, comes in under a special class—Franklin P. Adams,, conductor of "The Conning Tower" in the New York *Herald Tribune*. Mr. F.P.A. yells as follows:

One! Two! Three! Four! Five!
Who kept the quintuplets alive?
What makes the earth go round the sun?
Five! Four! Three! Two! One!
Publicity!
Publicity!
Publicity!!

Utter Silence Championship

IN contrast to the Yell Title Race which we are running through the courtesy of the College Emblem Shop, we are conducting the Utter Silence Championship, the prize for which is a handsome, streamlined loud speaker. Leading the race so far is the University of Michigan Board of Athletic Control and Fielding H. Yost for their performance before, during and after the Willis Ward (Negro)-Georgia Tech (White) incident. Our rather insistent sound-detector caught not one peep on this issue from the Ann Arbor contenders.

Pitt's "Floor" game

AN orthodox follower of the cult basketball, we were somewhat startled, as one might be who had just seen a vision, at a recent University of Pittsburgh (Dr. Carlson) game, to see the Pitt team make a sustained attack on the Fordham man-for-man defense by rolling the ball along the floor. It was not one or two rolls, mind you, but a long continuity of them, and it succeeded in not only freezing the ball but in scoring. Naturally the defense was baffled, as who wouldn't be to see the status quo upset by such revolutionary tactics. Surely Dr. Tugwell, and not Dr. Carlson, invented the Pitt rolling attack!

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MECHANICS OF TRACK RUNNING

Review of the research that has been done to determine factors in running efficiency

By Thomas Kirk Cureton

This is the second of Prof. Cureton's series of five articles on the laws of physics and body mechanics as applied to athletic performance.

"Running was regarded as a criterion of athletic superiority, and the characteristic of Achilles in Homer was the quickness of his legs."[1]

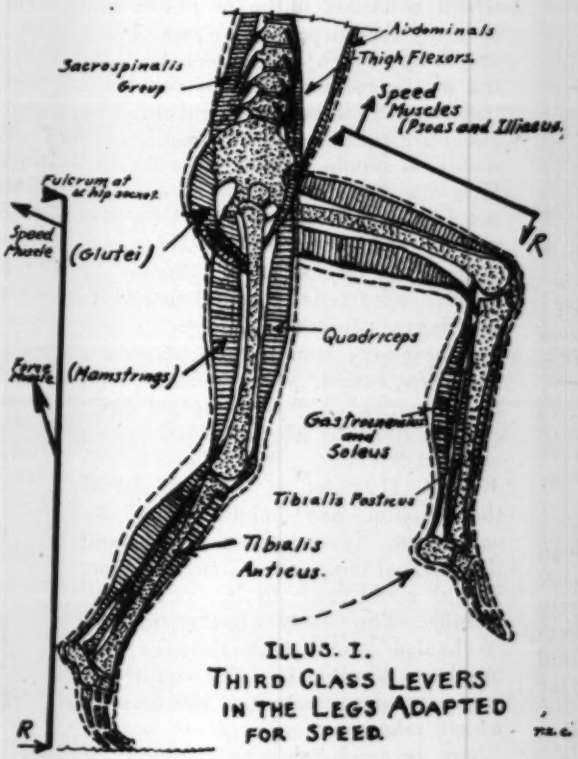
THE laws of mechanics govern bodily efficiency in athletic action. Internally, the muscles react to nerve stimulus in proportion to the magnitude of the nerve stimulus and the strength of the muscle. The body is marvelously constructed for both strength and speed. Running has been one of the oldest racial athletic activities and the body of a runner exemplifies not only efficient construction for the task but is an epitome in nature of practically all mechanical principles. Muscle force, which varies as the cross section of the muscle and the mechanical arrangement of the fibers, is transmitted to the bones which act as levers. The levers create mechanical advantage either for force or speed, unless the levers are of the first class balancing type as some of the postural levers. The human body is made more efficient for tasks like running because of its mechanical construction. This is particularly true with respect to leverage.

It is interesting to note that the leg as it swings back and forth in the hip socket under the pull of the hip muscles is a third class lever. This type of lever is the best type to transmit speed and large range of movement to its distal end. Since, in the human body this end is the human foot, the leg is an efficient third class lever to transmit speed of movement and a long range movement for the stride. Illus. I shows this arrangement. The fulcrum is at the hip joint. The resistance is at the end of the lever and the force between the fulcrum and the resistance. The leg is pulled forward by the thigh flexor muscles. It is pulled backward to the ground for the push by the Glutei muscles and also the Hamstrings. The muscles which bear the burden of the push against the ground are the Quadriceps and the calf group. These act to straighten the leg at the knee joint and to extend the foot as it pushes.

[1]Ballin, Hans, "Running," *Mind and Body*, Nov., 1894, vol. 1, p. 1.

Shorter legs would shorten slightly the resistance arm of the third class lever and permit greater force but not as much range of movement or speed, since speed requires a long stride. This comparison would hold only in case the same number of steps were made in the same interval of time.

The legs work back and forth in a way which resembles the pendulum action. The muscles provide the greatest portion of the force rather than gravity, in the physical pendulum. It is interesting to note that the leg can be recovered more quickly when the knee is bent. This is identical in principle with the law of the physical pendulum. If the length of the pendulum is decreased, it will swing faster.



ILLUS. I.
THIRD CLASS LEVERS IN THE LEGS ADAPTED FOR SPEED.

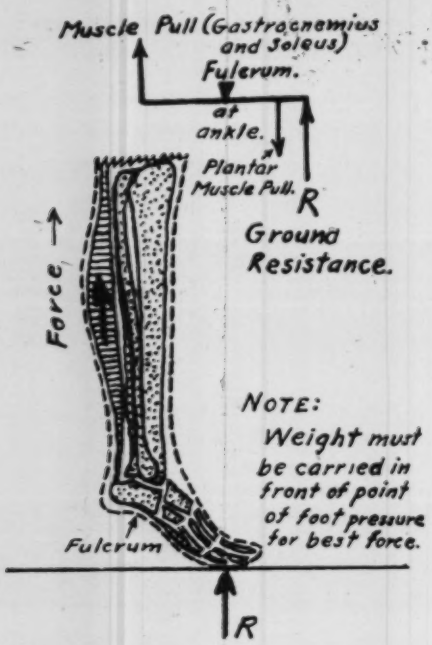
Thus, the human body adapts itself well to the requirements of running. When a long and full hind-push is required, the leg operates at its full length to give the greatest possible distance to the foot in travelling backward under the body. When quick recovery of the leg is required, the knee is sharply flexed to take advantage of the law of the shortened pendulum. Such an arrangement, however, sacrifices force to gain a long-range stride. Other muscles and levers supplement the action to keep the force up to all that is required. The Plantar muscles on the sole of the foot and the calf muscles aid tremendously, in fact, contribute most of the force together with the Quadriceps in straightening the leg.

The extension of the foot as it acts to push the toes down against the ground is again a leverage system. This is shown in Illus. II (next page). Here the system is much more powerfully adapted for force. The fulcrum is in the ankle at the end of the foreleg bone (tibia). The calf muscles shorten when in contraction and attempt to lift the heel. The opposite end of the lever is at the ball of the foot. The pull of the calf muscles is transmitted to the ball of the foot through the muscles on the sole of the foot and through the bones which are bound together with ligamentous attachments. There is not any dispute over the calf muscles being able to raise the heel. The balance cannot be maintained, however, if the center of gravity is back of the toes. A deeper muscle, the Tibialis posticus, is an important muscle as it keeps the weight on the outside of the foot and helps to support the longitudinal arch. A foot with a very low arch is thought to have less spring and strength for pushing. The strength of the calf group of muscles is very great. It is estimated that in a man with a well developed calf the contraction force would be at least 1200 pounds. The ankle, knee and hip joints straighten much as a spring would uncoil after being compressed. In some experimentation with a mechanical model which was constructed to jump, it was found that the elastic bands which represented the calf muscles had to be greatly increased to get better results.

Movement of the legs forward and backward involves friction in the joints. The acceleration and deceleration of the limbs uses up energy to overcome inertia. The muscles themselves are quick or sluggish in their elastic rebound in proportion to their relative state of viscosity. Force is transmitted from muscles to the levers by tendons. Sometimes the latter run in grooves and around corners just as ropes run around pulleys in a mechanical block and tackle system. These and many other examples might be given to show that the body is a machine which is regulated in its effi-

ciency by the same laws of mechanics which govern inanimate machines.

The internal mechanics can be improved. The muscles can be strengthened. Joint friction can be diminished by flexibility work. The event can be practiced enough until the best amount of innervation is secured to execute the movements without waste. Ultimately, only the muscles are used which need to be used in the action and waste is eliminated. A rhythm and ease of action gradually develops which is commonly called coordination. Viscosity of the tissues can be reduced



ILLUS. II.

by adequate warm-up either through exercise, preliminary running, massage or heat applications. One cannot help having long levers or very short levers if he has them but one can understand the power capacity of his body better if the mechanics are understood.

Externally, the force is applied to the ground to push it backward under the body as the body moves forward over the foot. Here again mechanics plays an important part. Efficient running is governed by how well the available force is directed. If the force is mostly downward into the ground, the part of the push which acts backward with a reaction acting directly forward is small. The mechanical principle involved is that the horizontal component of the applied force should be as large as possible. This will be further explained by a diagram. External friction must be overcome in the nature of ground friction (retardation upon contact) and wind resistance. There may be slip under the pushing foot to minimize the propelling force. The ideal is to run perfectly smooth but this is impossible. It is remarkable how smoothly the better runners do run. Inexperienced runners are jerky and use up energy to overcome needless inertia changes in the body parts. Man may be compared to a two-cylinder car having two propelling impulses each stride cycle. The eight-cylinder car has more impulses per cycle evenly spaced and the action is smoother operation. Unfortunately, man does not have eight legs. From the start the body must be accelerated up to maximum speed. Here again part of the propelling force is utilized to overcome inertia. Once the runner attains maximum speed less force is required to maintain it.

The external mechanics represent *form*. This is usually judged as to how the movements are controlled in direction, the angle of application of force to the ground, the carriage and alignment of the body, and the timing which produces optimum power and economy for the particular race. These are things which can be seen by looking at the runner. Each of these criteria may be shown to be governed by a mechanical principle. Form, in other words, is synonomous with mechanics. However, the internal mechanics cannot be seen. A runner may lack propelling force because of muscular condition. It is impossible to estimate the amount of friction around joints to any degree of accuracy.

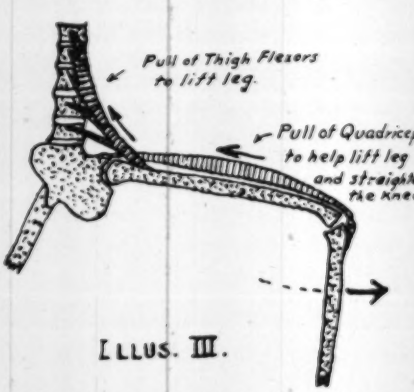
Kinesiology is the study of muscle and joint action. Many coaches want to understand why a runner is inefficient. Externally his mechanics can be checked but internally the problem is difficult. However, if he is to doctor the machine and induce better development, it is helpful to understand the internal mechanics of the machine, just as would apply to drivers of automobiles. The study of the internal mechanism is called kinesiology. As it has been developed in this country it is mostly identification of the muscles which take part in a given action. There is much more to the field of study than names of parts. Mechanical principles may be understood without knowing any of the names of the muscles.

Lawson Robertson has stressed the great part which the front thigh muscles (Quadriceps) play in fast sprinting. The leg must be recovered as fast as possible. This is done by the thigh flexor muscles (Psoas and Illiacus). The swift and powerful drive of the leg down and backward against the ground is due a great deal to the action of the Quadriceps in straightening the leg against the ground resistance. The whole body weight must be overcome. These muscles are shown in Illus. III.

Muscle fatigue affects the mechanics. For instance, a runner who usually runs on the toes will let down and run more on the whole foot when fatigued. This is attributed to the fatigue of the calf muscles. A long striding runner will shorten the stride when he is very tired. A sprinter who usually employs a high knee action will diminish its height when tired. The distance runner employs a great number of these economizers to run most efficiently over a long distance.

The push is most important because from this comes the force of propulsion. The front thigh muscles help in straightening the leg but the posterior thigh muscles (the Hamstrings) and the hip muscles (Glutei) are the principal muscles which drive the thigh backward. Running force is directly dependent upon these and also the calf (Gastrocnemius and Soleus) muscles. The foot is straightened and the body rises on the toes in the push from the ground because of the contraction of the calf muscles. When these tire the runner lets down to the flat-foot style and the stride is shortened (Illus. II).

The trunk is held in alignment with the desirable body lean by the extensor muscles of the back (Sacrospinalis group). These muscles, particularly the lower back group, hold the pelvis firm so that the leg muscles which have their attachment to the pelvis can have a firm base upon which to act. The abdominal muscles likewise aid in fixation of the pelvis and permit a more forceful action of the leg muscles. This is one of the greatest reasons why sprinters should run with their breath held. It is impossible to



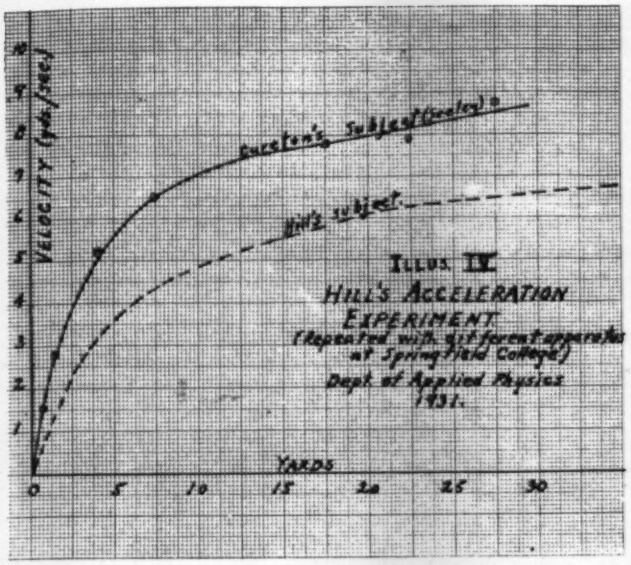
ILLUS. III.

The Quadriceps hold the leg straight while the hip muscles act.

take a deep breath anyway when the abdominal muscles are in vigorous contraction. They are secondary (synergic) muscles but an important group.

Body size and physical type as related to running. Wide variations in body size or physical type[2] affect the

[2]Body build may be computed by wt./ht.^{2}, the Davenport index, or by Bouchard's wt./ht. These correlate with each other almost perfectly. The former result is multiplied by 1000 to bring the figures into whole numbers. The latter is used directly. The types are classified as follows: Davenport Index: Linear = 20.0 to 30.0; Medial = 30.1 to 33.0; Lateral = 33.1 to 45.0. Bouchard Index: Linear = 1.5 to 2.0; Medial = 2.1 to 2.2; Lateral = 2.3 to 3.0.



ILLUS. IX
HILL'S ACCELERATION EXPERIMENT
(Repeated with different apparatus at Springfield College)
Dept. of Applied Physics 1931.

internal mechanics. In general the shorter, heavier men are built for strength or force effort. The medial types are pretty well adapted for both strength and quickness of movement. The linear types are built for speed with relatively small but sometimes longer bones. There has been much speculation as to the best body build for running.

Possibly the most important study on the relationship of body build to running is that made by W. Kohlrausch[3] on the 1928 Olympic contestants at Amsterdam. This study shows that the twenty-two best sprinters of the world average 142.3 lbs. in weight, 67.9 inches in height, have a weight/height index of 2.17 and a vital capacity of 4300 c.c. Lawson Robertson[4], American Olympic coach, has called attention in a general way to the fact that there are more good sprinters of small size than large. It is the exception for very tall men to have muscles in proportion to the length of their bones. Thus, the greatest proportion of the world's best sprinters have been medium to small sized men, such as Hahn, Walker, Rector, Tolan, Duffy, Paddock, Scholtz, Wykoff and Murchison. There have been a few notable exceptions to this rule as exemplified by men like Abrahams and Metcalfe. Heavy set and fat (lateral) types as a rule do not make good sprinters.

The Kohlrausch study shows that the twenty-three best 400 meter runners average 143.7 lbs. in weight, 69.2 inches in height, 2.10 in body build and 4500 c.c. for vital capacity. There is a trend here toward a taller, thinner type. Some of the best in this class have been rangy types, such as Ben Eastman. However, Bill Carr, who is five feet seven inches in height and 143 lbs. in weight, defeated him in the 400 meters. Robertson points out the great performances of Lon Myers, who weighed only 125 lbs. Williams and Meredith weighed about 150 lbs. at the time of their 47 2/5 sec. performances. A runner with a heavy build like that of Barbuti, 400-meter champion in the 1928 Olympics, is an exception. He created great surprise in winning the event.

The twelve best middle distance runners in the 1928 games were measured by Kohlrausch to be men averaging 146.7 lbs., 68.9 inches tall, 2.19 for body build and 4800 c.c. for lung capacity. Men like Bill Bonthron, Jack Lovelock and Glenn Cunningham would fall into this class with small variations. Nurmi, Joie Ray, Lloyd Hahn, Jules Ladoumegue and Luigi Beccali are average or under in body size.

Distance runners average smaller and slighter of build than the previous class. This is borne out by Kohlrausch's study showing the Amsterdam contenders, fifteen in number, to average 132.7 pounds in weight, 66.8 inches tall, 2.10 in body build and 4300 c.c. vital capacity. The Finns are practically all men of slight and medium build, such as Nurmi, Lehtinen, Ritola, Iso-Hollo and Virtanen. Zabala, the 1932 marathon winner, and Kusocinski, the Pole, are short.

Studies on body build at Springfield College. Studies made under the direction of the writer at Springfield College show that lung capacity[5] is only slightly related to running ability. The better 440 yard runners have slightly greater calf girth.[6] A study of the length of legs[7] as related to both the 50 yard dash and the 440 yard run showed little of significance, but the group with medium length legs gave slightly better performance as an average in both of the above events. A study on body type[8] indicated clearly that the linear type gave better average performance than the medial or lateral types:

	Linear	*Medial*	*Lateral*
50 yard dash	6.33 sec.	6.466 sec.	6.539 sec.
440 yard run	67.03 sec.	69.1 sec.	72.33 sec.

McCloy's Track and Field Tables. The most extensive research into body build, age, height and weight as related to track ability among schoolboys has been made by Dr. C. H. McCloy,[9] of the State University of Iowa. His results show that age, height and weight are all factors which affect one's ability to sprint 100 yards. Age and weight are greater factors than height in boys under fourteen. Height is more of a factor after this age. He argues that an increase in weight should increase performance because more than half of the increase goes into muscle and strength governs performance to a large extent. One outstanding finding is that chinning ability is the best exercise to estimate running ability. Running speed seems to depend upon the strength of the arms. With boys he was not able to show that body build was a factor as determined by the ponderal index.

MacCurdy's Physical Capacity Test. H. L. MacCurdy[10] has just completed a doctorate at Columbia University which demonstrates that physical capacity is pre-requisite for success in athletics. Proof is given that running ability is governed to quite an extent by strength as measured by a battery of strength tests. In studying a large group of high school boys the varsity track athletes were all in the upper 60% in physical capacity as measured by strength and ability to jump vertically. MacCurdy's test was built upon the foundation of some earlier work of

[3]W. Kohlrausch, *Zusammenhange von Korperform und Leistung, Ergebnisse der anthropometrichen Messungen an den Athleten der Amsterdamer Olympiade*, Julius Springer, Berlin, 1929.

[4]Lawson Robertson, see series of three articles on running in Street and Smith's *Sport Story*, 1934.

[5]Chisholm, E. A., project in anthropometry and body mechanics, 1933, r = .183 (115 subjects, college freshmen); Purrington, D. W., project in anthropometry and body mechanics, 1933, r = .181 (117 subjects, college freshmen). Attenuation uncorrected in both correlations.

[6]Purdy, R., project in anthropometry and body mechanics, 1933, r = .117 (102 subjects), no attenuation correction.

[7]Wheeler, R. D., project in anthropometry and body mechanics, 1933.

[8]Graham, D. F., project in anthropometry and body mechanics, 1933 (113 subjects).

[9]McCloy, C. H., *The Measurement of Athletic Power*, A. S. Barnes & Co., 1932, N. Y., pp. 46, 55, 64, 86, 91, 94.

[10]MacCurdy, H. L., *Physical Capacity Test for High School Boys*, doctorate, Teacher's College, Columbia, privately published, 1934, pp. 24, 28, 34.

[11]Rogers, F. R., *Physical Capacity Tests in the Redirection of Physical Education*, Teacher's College, Columbia, 1925.

Dr. Frederick Rand Rogers.[11] Rogers had previously demonstrated a very high relationship between sprint running and the strength index.

Sprinters have faster reaction time than distance runners. Muscles can act only as they are controlled by the nervous system. The speed of the neuromuscular response is called reaction time. Experienced coaches know that the best sprinters are quick, nervous types. They seem to have a great deal of nervous energy. An important study has shown that this quality is a most important factor in the selection of sprinters. Westerlund and Tuttle[12] have demonstrated almost a perfect relationship between reaction time and the ability to sprint 75 yards. There seems to be concensus of opinion that this quality can be improved by training but the inner secretion of the glands have been suspected of having the greatest influence.

ILLUS. VI.

Type of Runner	*Reaction Time*
Champions	121 sec.
Sprinters	131 sec.
Middle Distance	149 sec.
Distance	169 sec.

A. V. Hill's experiments on runners at Cornell. A. V. Hill, famous English bio-physicist, studied runners at Cornell for one year. His report treats deeply of the dynamics of sprint running.[13] From experimental data he has derived an equation which explains sprint speed. When this equation is simplified from its calculus form it becomes the familiar Newtonian law for accelerated motion, treated with resistance considered:

$$F - R = Ma$$

Key: F = Propelling Force. R = Internal joint and viscosity resistance. M = Mass of the Runner. a = acceleration (change in velocity per unit of time over a definite distance).

He demonstrated that F (the propelling force) varied from .5 to 1.0 times the body weight. This conclusion was partly based on other studies. For experienced runners the value is nearer .8 times the body weight. The value R was computed from muscle viscosity data. Hill measured the speed of the runner at intervals all along the track and from this data could compute the acceleration. He was thus able to show that the equation would balance. Hill's acceleration experiments were repeated at Springfield College in the fall of 1931. The apparatus was of different design but permitted timing the runner at intervals of five yards (Illus. IV on page 9).

This experimenter has made many famous studies on runners. He demontrates that the average good sprinter does not reach his maximum speed until he is away from the holes about 60 yards. He also has demonstrated the relationship between oxygen required and the speed. On the basis of oxygen used he has been able to compute the speed or the foot-pounds of work done. This has led to calculations which show that runners have a mechanical efficiency of 23%, computed on the basis of the ratio between effective mechanical work done and the total energy consumption. Muscles alone give 40%. The loss is due to internal joint friction including the pull of antagonistic muscles.

Propelling force is mechanical key to speed. The body is propelled forward by the push backward against the ground. This push comes into the ground at an angle and hence some of its effectiveness is lost. This is made clear by Illus. V (Page 9). Here the total applied force is resolved into its two rectangular components, the horizontal component being the effective force for propulsion. It may be noted that this is less than the total applied force, taking the forces to be proportional to the length of the lines shown. The vertical component is waste as far as propulsion is concerned. The force of the push is due to vigorous extension of the hip, knee and ankle. It is interesting to note that the effect of raising the knees high in front is to move the center of gravity forward and thus make the angle less. The propelling force is thus made more effective by raising the knees high. Of course, this is tiring and cannot be used with success over long distances. It is one characteristic of the sprinting style. Raising one knee forward moves the center of gravity forward approximately two centimeters; an arm forward moves it another centimeter. To aid the body angle the arms should be carried well in front of the body in sprinting.

The recovery action of the arms and legs aid in reinforcing the force of the push and also move the center of gravity forward to maintain the desired body angle. Sprinters should endeavor to drive their arms forward with vigor and also to recover their legs quickly so that they can get a high knee action. Kicking up too high behind will not permit this ideal to be obtained.

Distance runners are faced more with conserving their energy. They are forced to recover their legs slower and move their arms less vigorously. The arms and legs resemble closely the pendulum action but with muscle force rather than gravity being the activating force. Nevertheless, the longer a pendulum the slower it will swing. Bending the knee on the recovery shortens the pendulum and permits a faster recovery of the leg. This is also economical from the point of view of endurance because the muscles are stretched after being contracted. This is why a man can run both faster and longer under maximum effort with the bent knee style than with straight legs.

Fast running requires a long stride. The faster a man runs the longer his stride becomes. This was one of the earliest observations made on running. The Weber brothers[14] made this observation in Göttingen and Leipzig in 1836. It has been verified many times since. Photography was used in France by Marey to prove this observation. When a runner passes another runner it is observed that the rate of stepping is not increased in the better runners but that as a rule the stride is lengthened, perhaps because of a more forceful push. A sprinter uses relatively short steps to get under way but as soon as the speed increases they are very long. Distance runners have much shorter strides to go with their slower pace. A brief summary table of the Weber observations illustrates this point:

Duration of Step (sec.)	*Length of Step (m.)*	*Speed (meters/sec.)*
0.326	0.934	2.862
0.301	1.209	4.021
0.268	1.542	5.745
0.247	1.753	6.66

Step or Stride Style? There is much debate as to whether the *step* or *stride* style is best. Nurmi's running has been observed to be the stride style. A recent article by Ohls[15] describes the Finnish running style which has been modeled after Nurmi. The stride style is the middle dis- [Concluded on page 25]

[12]Westerlund, J. H., and Tuttle, W. W., "Relationship Between Running Events in Track and Reaction Time," *Research Quarterly*, American Physical Education Association, Oct., 1931, pp. 95-100.

[13]Hill, A. V., *Muscular Movement in Man*, N. Y., 1927.

[14]Weber, E., and Weber, W., "Mechanik der mensch. Gehwerkzenge," Gottingen, 1836. Quoted by Hans Ballin, "Running," *Mind and Body*, Nov. 1894, vol. 1, p. 1.

[15]Ohls, Runar, "How the Finns Run," Street and Smith's *Sport Story*, Aug. 1934, pp. 55-62.

WISCONSIN REPLIES TO PROF. EASTWOOD

By P. F. Neverman

Illogical conclusion to football fatalities study reached by New Yorker in his speech before coaches

FLOYD H. EASTWOOD of New York University has made a real contribution to football through his painstaking and intensive study of injuries occurring in the sport. This study covering a period of four years led to a number of recommendations which were released from New York at the time of the annual meeting of the American Football Coaches Association. Prof. Eastwood gathered worthwhile facts, but when making his summation allowed his figures to confuse him, with the result that his conclusions were not in keeping with the actual findings. Because the total high school fatalities reported were greater than those for any other group, the results were broadcast as a challenge to the high and preparatory schools of the nation to cut down their deaths and bring the safety of their game and the care of their players up to the level of the colleges.

In reply to this challenge I will show that Prof. Eastwood's study, instead of revealing high school football as more dangerous than college football, reveals it as considerably safer —on the basis of Prof. Eastwood's own figures.

It is safe to assume that most persons who saw the newspaper accounts of Prof. Eastwood's New York speech (the national news services carried the story to papers throughout the country), or listened to the radio accounts of it, accepted the interpretation put on it by Prof. Eastwood himself, without seeing the fallacy in it.

Prof. Eastwood's mistake lay in basing his conclusions on the total football fatalities recorded in each group (college, high school and prep school, sandlot, athletic clubs). The conclusions should have been based on the total football fatalities in each group in relation to the number of participants in each group.

When it is realized that 80 percent of all football players are high school and prep school football players the misleading nature of Prof. Eastwood's statement is apparent.

College football has only 7 per cent of total players, sandlot competition has 10 per cent while athletic clubs enroll only 2 per cent. A thorough study of Wisconsin shows that approximately 20,000 boys participated in football during the 1934 season on high school—public, parochial and private—teams, 18 colleges, 2 universities, in the organized athletic clubs maintaining regular schedules and the so-called organized sandlot teams. The only figure which is not entirely definite is that of sandlot participation, but Wisconsin, with its fairly well organized municipal recreations, offers a reasonable basis for determination of figures. Of the 20,000 boys about 16,000 participated in the high school game, 1,400 for colleges and universities, 600 for athletic clubs and 2,000 in sandlot teams. A checkup made in seven other states for previous seasons shows about the same percentage.

The football fatalities table which Prof. Eastwood used to show that high school football is more dangerous than the college game follows:

	1931	1932	1933	1934	4-Yr. Ttl.
Sandlot	10	11	8	4	33
Athletic club	3	6	4	3	16
High school	12	12	13	13	50
College	8	3	2	3	16
Totals	33	32	27	23	115

The only basis on which sound comparative figures can be based is on the total number participating in each group. Accepting Prof. Eastwood's own figures on fatalities, we reach the following interpretation:

Ratio of Fatalities to Number Participating

High Schools: 80% of total participants with 44% of fatalities.

Colleges: 7% of total participants with 14% of fatalities.

Sandlot: 10% of total participants with 28% of fatalities.

Athletic Clubs: 3% of total participants with 14% of fatalities.

It will be noted that high school fatalities have a percentage of the total of about one-half of player ratio. The college percentage is two times that of player ratio, while that for athletic clubs is almost five times. The sandlot ratio is 2.8 that of player ratio. When the total number of participants is considered, the high school game is almost four times as safe as the college game.

The six recommendations made by Prof. Eastwood are pertinent and worthy of study. Had the study included a real effort to find out what the high schools were actually doing, the recommendations might not have been quite so general in character. The following are the six points made by Prof. Eastwood, with my comment on each.

"1. An association of high school football coaches to do in high school football what the American Football Coaches' Association has done for the college sport."

In a number of states high school coaches associations have been in existence for some time. State High School Athletic Associations, which associations exert more influence and control over high school football than could any national association of coaches, are functioning in each of the 48 states. Thirty three of these associations are members of the National Federation. Some of these State Associations have been in existence since 1895.

"2. Raise the standards for employment of high school coaches, requiring them to have, in addition to football and coaching experience, advanced courses under leading football teachers."

The average standard for high school coaching is fully as great as that required by many colleges.

"3. Teach a rolling rather than a head-on tackle; to block so that the soft parts of the body will be contacted; to tuck in their chins when falling backward after being tackled or blocked in order to avoid concussion."

The "professional" tackle, sometimes called the rolling tackle, is one which both colleges and high schools could teach to advantage.

"4. Provide a thorough physical examination before practice or a game."

This is a splendid recommendation. A few states already have this requirement. Wisconsin, for example, has had the physical examination before participation as a mandatory requirement for years. Parental permission has been required since Dec. 26, 1898. Physical examination has been advised since Nov. 8, 1912. Since Nov. 8, 1923, a thorough physical examination has been required.

"5. Provide adequate first aid facilities on the field of play to decrease deaths from infection."

Practically all Wisconsin high schools provide first aid. A majority have medical attendance at games. A number of other states make similar provision for the care of their players.

"6. Observe caution in seeing that a player is thoroughly 'warmed up' before he is sent into a game."

The proper warming up of players can not be over-emphasized. All coaches, both college and high school,

[Continued on page 26]

THE HEART OF AN ATHLETE

By Peter V. Karpovich, M.D.

"A 'burnt up' athlete is usually an overtired athlete, and can be restored to normalcy by rest"

SUPPOSE a small child is forced to shovel a ton of coal a day, every day of the week. Even if the work were spread over many hours, say eight or ten, still it would appear as rather hard work for the child. Yet this is the amount of work performed daily by a small organ weighing merely ten ounces—the human heart.

The heart pumps about a gallon of blood every minute while the person is at rest and about five gallons a minute when the person is engaged in some strenuous physical exercise. Dr. A. V. Hill calculated that the amount of blood circulating through the heart in one year is about 500,000 gallons, and in sixty-five years about 30,000,000 gallons.

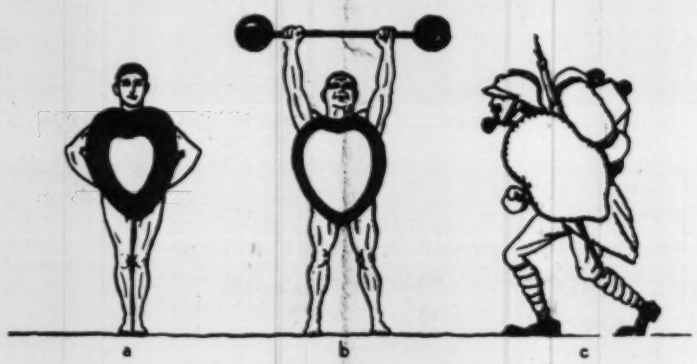
Adaptation of the heart to the exercise. Since no prolonged muscular work is possible without an increased circulation, it is obvious that the heart should be able to meet this increased demand. In the preceding article it was mentioned that the process of adaptation consists of an acceleration of the pulse rate and an increase of the stroke volume (the output of blood with every heart beat). As we know, the heart is made of muscle tissue, and we also know that the exercising of a muscle results in its development. The muscle becomes thicker and firmer. This condition is not due to any increase in the number of the fibers making up the muscle, because their number remains the same, but is due to the thickening of the individual fibers. This kind of development is called hypertrophy.

The hypertrophy of the heart is a normal adaptation of this organ to the demand and means a stronger heart. Many observations have been made on animals which showed that the same is true everywhere.

The weight of the heart per 1000 of body weight.

Deer	11.5	Sheep	6.0
Chamois	10.0	Man	5.0
Hare	7.7	Pig	4.5
Birds			
Falcon	19.0	Pigeon	13.0
Swallow	15.0	Woodgrouse	4.0

Experiments conducted on dogs showed that the hearts of the animals which were compelled to exercise were larger than the hearts of the idle dogs of the same breed. Dr. Kuelbs found that the same is true for pigs. The hypertrophy of the heart develops gradually and disappears gradually if the exercises have been discontinued. One should bear in mind that there is a certain correlation between the weight of the active tissues of the body and the weight of the heart. A mere fattening of the organism does not lead to an enlargement of the heart muscle. Suppose you put a wild rabbit in the cage and then kill him six months later. The ratio of the weight of the heart to the body weight will be less than in a wild rabbit at liberty, but it would be a mistake to regard this as pure loss in weight of the heart. The chief reason for this change is the increase in the body weight due to a general fattening of the rabbit brought about by the forced inactivity and good feeding.



THE STRONG AND THE WEAK HEART*

a) and b) is a strong hypertrophied heart of an athlete. Although it becomes distended during strenuous work, it immediately comes back to normal after the work. c) is the heart of a poorly trained soldier during strenuous work. It becomes distended and may remain so for some time after the work.

If the heart is small and not sufficiently strong, a vigorous exercise can be maintained but a short time and the person will rapidly experience a circulatory and respiratory distress.

Athletic Heart

An average coach of a small school is, unfortunately, compelled to give a good competitive show regardless of the number of the pupils in his school. The local board of education, the alumni and the local paper demand more trophies, more scalps, or else . . . And what is the result? The result is well known to all of us. Seldom have we the courage to speak against these forces and seldom are we listened to.

Dr. J. E. Raycroft in his Wingate Memorial lecture gave a dramatic account of the athletic activities of one outstanding school athlete. This boy played football, then took part in indoor track, played baseball and participated in outdoor track. Probably some one can cite cases of participation in five sports. Raycroft says that this is not a typical case. It is true. But it is also true that an outstanding all-round athlete is not a typical student. A conscientious physical director wants to give enough athletics to every student, enough competition to taste the joy of achievement, and would not harm a boy purposely. The unfortunate part here is a lack of the exact knowledge of the effects of the various activities upon the organism. What will happen to a good athlete who is taking a very active part in four sports? Can any one answer definitely? Of course not. The best guess is that he will fail scholastically. Even that may prove to be a wrong guess. If everything is so indefinite, then how can we predict permanent injury to the heart?

The Athletic Heart is a misnomer. It conveys the unfortunate idea that this kind of heart is typical of the people engaged in athletics. We can define an athletic heart as a pathological condition in which the heart becomes dilated and functionally weak. Does this ever happen? It happens to people with some predisposing cause. During the convention of the sport-physicians in Germany in 1927, where some of the leading physiologists and clinicians were present, this topic was intensely discussed. The amazing thing was that although much had been said about the injuries to the heart due to athletics, the number of cases found were extremely small. A thorough investigator like Dr. Herxheimer cautioned physicians to weigh all the factors before attributing any organic injury to the sport. The symptoms should be quite severe and the previous history negative before one can state definitely that the cause of this injury was strenuous physical exertion.

Cardiac symptoms due to overexertion. According

[Continued on page 28]

*From *Traite D'Education Physique* by M. Labbe and Bellin du Coteau, Paris, Gaston Doin & Cie, 1930, Vol. I, p. 213. Illustration used with permission of the publisher.

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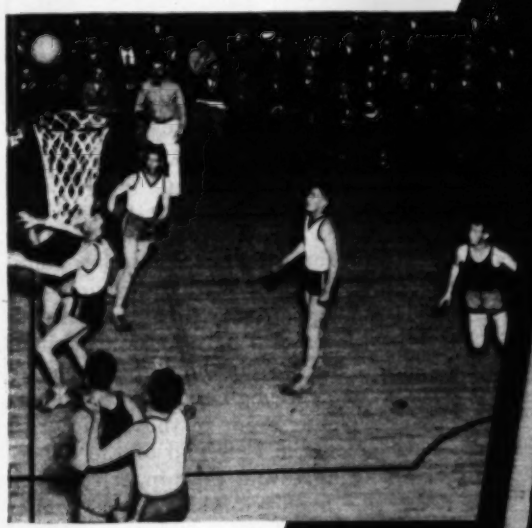

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First two articles of a series of nine by outstanding players at each position.

Introduction by

Will Harridge

President, American League

It is with great satisfaction that I endorse the action of Scholastic Coach in publishing a series of articles of instruction in baseball by well known professional players. I have noted with great interest the return of baseball to the athletic programs of many high schools that had found it necessary, for one reason and another, to discontinue the game. The publication of this series should serve as a further stimulus to high school baseball, presenting, as it does, technical slants on the game from those who are rarely heard from on this subject, but who are eminently qualified to speak. I will now step aside and make way for these experts, who were interviewed along the desired lines by Henry P. Edwards of the American League Service Bureau.

CATCHING

By Mickey Cochrane

Manager, Detroit Tigers

IF I were starting all over again in baseball, and could have any position I chose to "go out for," I would take up catching again. It is not only because I enjoy the special kinds of movements that a catcher goes through, but because I enjoy doing well a job at which it is so difficult to find first class performers. The catcher's job is an extremely busy one and a hard one, but those who do it well get a full measure of satisfaction out of it for this very reason. Just to indicate how rare good catching material is in the big leagues consider that major league scouts, and there are fifty of them, have spent much time during the last few years trying to discover some young catchers who looked as though they had the ability to make the major league grade within a few years. They traveled from coast to coast, from the gulf to the Canadian border; they followed practically all of the college teams; they did not overlook the sandlotters, and yet there was not a young catcher who made good in the American League in 1934 while only one first-year man delivered the goods in the National League.

You coaches may be having the same experience—you cannot find or train a catcher whose standard of play is up to the team's standard. It is not that the boys of today avoid an activity simply because it is hard and for this reason prefer not to catch behind the bat. The shortage of good catchers is more likely caused by the very nature of the job itself, rather than the nature of the boys.

Of course backstopping is no position for a sluggard or any player who does not wish to keep right on his toes and be on top of the game every minute he is in there.

It is up to the receiver not only to catch the varied assortment of pitches thrown to him with a minimum of passed balls, but he is also expected to steady his pitcher, call for the right ball in the right spot, inspire his teammates, do more or less jockeying with the batsman so as to throw the latter off his stride, block runners from the plate and, in a way, be the field general of his team on defense.

Mickey Cochrane: "My system is to keep the right hand closed until the ball strikes the big mitt and then clap my fingers across it."

A young catcher should learn to protect his fingers from injury. I could give the names of a dozen veteran catchers whose fingers are just as straight and free from fractures as the day they started behind the bat. One never would know by looking at my hands that I have caught close to 1,700 games and in those contests been forced to handle some extremely tough deliveries. My system is to keep the right hand closed until the ball strikes the big mitt and then clap my fingers across it.

Most big league catchers stand as close as possible to the batsman, with feet spread and well braced, the left foot slightly in advance of the right, so as to be in a position to throw to the bases without undue footwork, and also to take a wide pitch more easily.

The best catchers in the major leagues depend upon a snap throw employing the forearm in the effort so as to waste no time in drawing back the whole arm for an overhand throw. If the young catcher, however, cannot develop the snap throw readily, he will have to use the overhand method until such time he is able to master the correct way of getting the ball away.

Detecting batters' tip-offs

The smart catcher will study each batsman intently. By so doing he may discern some slight movement which will tip him off that the batter has his mind made up to step into the next pitch, in which case he should sign the pitcher for a bad ball, feeling confident the batsman will go through with his swing anyway. If the catcher knows a certain batter has a habit of pulling away from the plate, he should call for curve balls on the outside. If the batsman is one of those who grips his bat at the very end of the handle and swings from the hip, a fast ball on the inside would be the proper pitch.

Practice, plenty of it, will cure a catcher of being weak on foul flies. When I first joined the Athletics I was notoriously weak in that respect but Mr. Mack had me working overtime to overcome my fault and I finally acquired the knack.

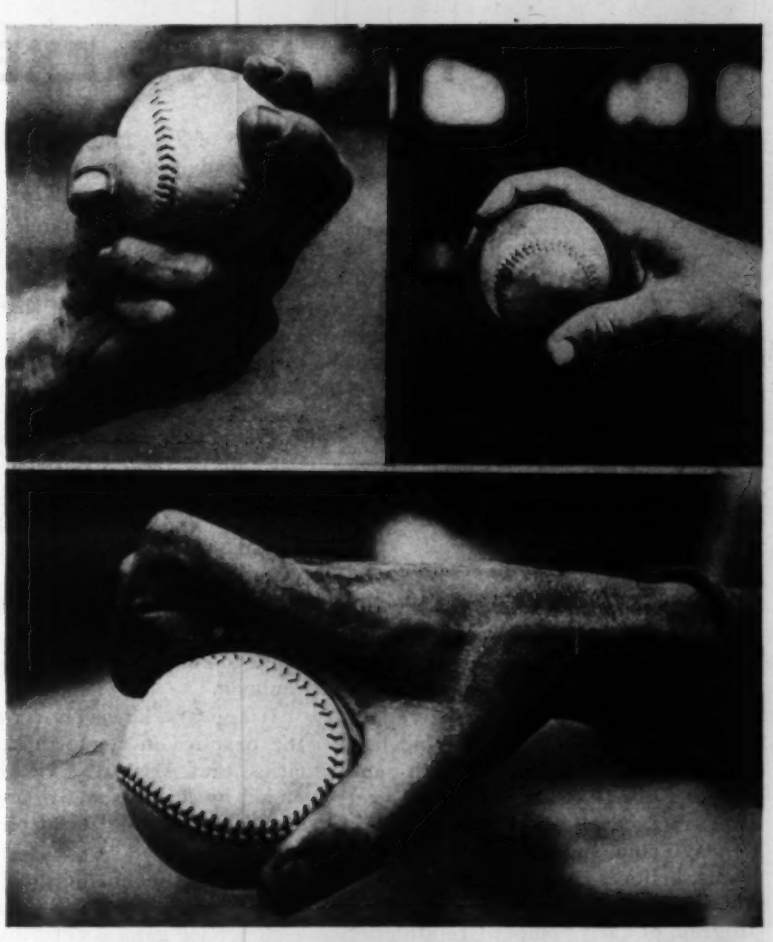
The catcher should always keep his hands and wrists relaxed. Otherwise, he will be likely to fight the ball, and many a fumble or passed ball will result.

Possibly one of the toughest things a catcher has to do is to retire a runner at the plate when he is trying to score on a base hit. The catcher is required to block the plate, legitimately, of course, keep his eye on the ball coming in from the outfield and tag the runner. Some young players make the mistake of tagging the runner on the leg or body when they should tag him on the foot. If the ball is applied to the body or leg the runner's foot may be on the plate and consequently the umpire will declare him safe.

PITCHING

By Ted Lyons

Chicago White Sox



UPPER LEFT—CURVE BALL HELD BY WALBERG. UPPER RIGHT—STRAIGHT BALL, BY EARNSHAW. BOTTOM—KNUCKLE BALL, BY ROMMEL.

THE day has gone by when all a pitcher needed was a fast ball, a glove and a prayer. At least, this is true of the big leagues where nearly every pitched ball is a duel between a batter who knows a bad ball when he sees one and a pitcher who knows that the batter also knows. I realize that in high school baseball, and in much college baseball, a team will often get by with a pitcher who has steam and nothing else in the way of baseball attributes. This is because the batters are either afraid of him or have not been properly trained in batting.

If I were coaching a high school team I would look over my pitching candidates with a favoring eye for the boys who have long loose muscles in their arms, who are close to six feet in height, well built with no excessive weight, a good pair of shoulders and the quality of mental alertness which will enable them to play every tactical situation for all it is worth.

Walter Johnson, one of the greatest pitchers of all time, had the long loose muscles I refer to. They enabled him to pitch with a free easy motion and last in the American League for twenty years. Herb Pennock, noted for his control, is another. Others are Bob Grove, George Earnshaw, Lefty Gomez and Mel Harder. Going over to the National League, we find a splendid example of such a type in Jerome (Dizzy) Dean. He is another Walter Johnson and may last as long as the latter. He has the same free motion that Walter had when he was in his prime.

How is the coach going to ascertain if his pitching pupils have the long loose muscles? He should try them out throwing their fast ball for a pitcher certainly cannot get very far if he lacks a fast one. If they can get the speed ball away smoothly and it has a hop on it, you will know their arms have been fitted by nature for such a knack. Short muscles tend toward a jerky motion and lack of control with the owner acquiring a sore arm more easily than the long-muscled pitcher.

After a young pitcher has shown he has his fast one working satisfactorily —concentrating on controlling it, shooting it over high and low, inside and outside—he should develop a curve ball and then acquire a change of pace. Then, if a pitcher wishes to add a screw ball or fadeaway, a knuckle ball or fork ball, he will be forced to devote much time to practice with each. The owner of fast and curve ball with a change of pace and control, however, will last much longer than one addicted to the fancy or freak deliveries.

The young pitcher should be allowed to use the delivery—overhand, sidearm or underhand—that comes most natural to him. I knew a most promising prospect who was naturally a sidearm pitcher. At training camp the coaches decided he should be an overhand pitcher. He was drilled as such and then sent back to the minors for development. He went weeks without winning a game. He was about to quit when the scout who had taken him from college dropped in to ascertain what was the trouble. When the scout discovered he was trying to pitch overhand he made him shift back to sidearm, and the young man was a winning pitcher the following year.

Stanley Coveleskie was one of the greatest spitball pitchers in our league but there was one club he seldom could defeat. That was Detroit. Why? A smart man in the coacher's box, by careful study of Coveleskie, could tell whether or not he was going to throw his spitter or fast ball. He flashed a sign to the batter and the latter waited for the fast ball. Tom Bridges of Detroit, a great curve ball pitcher, has been able to beat New York but once in four seasons. Why? Art Fletcher, Yankee coach, is able to tell when Tommy is going to throw his curve and when he is going to shoot his fast ball over. As a result, Bridges simply finds it almost impossible to go nine innings against New York.

These two examples lead up to the positive need of every pitcher to be able to avoid telegraphing what he is going to throw. He must be able to adopt exactly the same delivery, even down to the very last move, in throwing a curve that he uses in hurling his fast ball. The coach must watch him carefully and, if the young pitcher has such a fault, work tirelessly to eliminate it.

Golf pros elaborate upon the necessity of the player "following through" with his drive. It is just as necessary for a pitcher to "follow through" with his pitch. By so doing, he is able to put more on the ball and, at the same time, be in a far better position to field the ball if it is hit. The pitcher who does not follow through does not utilize his full power. He develops a jerky motion and with it lack of control.

[Concluded on page 24]

WHAT IS TOO MUCH EXERCISE?

By Floyd A.Rowe

Mr. Rowe is the directing supervisor of the Bureau of Physical Welfare of the Cleveland, Ohio, public schools. A former coach of football, basketball and other sports in Montana high schools and at the College of Montana, Mr. Rowe has been active in the field since his graduation from the University of Michigan in 1908. He took up his present post in Cleveland in 1923. As general chairman of the Committee in charge of last year's convention of the American Physical Education Association in Cleveland, he and his staff were the recipients of many a compliment on their staging of the pageant "Olympia Through the Ages," which depicted phases of physical education from the Ancient Greeks to the present day.

NO one seems to know with any particular degree of certainty just what the proper prescription of physical activity is for any one individual or any group of individuals. Many people have opinions and have expressed these opinions with more or less force. Lawson Robertson, veteran track coach at the University of Pennsylvania and American Olympic teams, believes that many boys are being damaged rather permanently by a program of early competitive athletics. Those interested in Coach Robertson's viewpoint are referred to his article "Burning Up Boyhood" in the February 24, 1934, *Saturday Evening Post.*

It would seem that Robertson's viewpoint was not a particularly new one, since Aristotle, writing between the years 344 B.C. and 342 B.C. in Book 8 of *The Politics,* makes the following advised statement after a study of the Olympic records of 432 years:

"The evil of excessive training in early years is strikingly proved by the example of the Olympic victors; for not more than two or three of them have gained a prize both as boys and as men; their early training and severe gymnastic exercises exhausted their constitutions."

He further says: "Avoiding severe regimen or painful toil lest the growth of the body be impaired." "Early training and severe gymnastic exercises exhausted their constitutions." "When boyhood is over, three years should be spent in other studies; the period of life which follows may then be devoted to hard exercise and strict regimen."

It appears, however, as indicated by the practice in vogue in many of our cities, that Aristotle's views, ably seconded by Robertson, are not the views of the modern teacher of physical education.

With the advent of the junior high school, many of our highly competitive high school games were pushed down to a lower age level by being included in the program of junior high school activities. Speaking plainly, regulation football as played in high school and college is being played in junior high schools. The same is true with basketball and, with some small change in events, track athletics.

No one seemed to give this matter much thought. High school boys played football, basketball, and competed in track athletics. With the coming of the junior high school, a program of activities for boys was necessary. What more natural than to simply begin the activities of the traditional high school two years earlier? This is exactly what happened.

Opposed to the point of view expressed by Aristotle and Robertson, one finds men like Hetherington and others advocating as much as four or five hours daily activity for growing children. If Aristotle and Robertson are right, can Hetherington and his followers also be right?

Basing my opinion on objective evidence, I believe Aristotle, Robertson, and Hetherington are all stating truths. Aristotle and Robertson wrote about competitive athletics. Hetherington wrote about opportunity for physical activity. It is certain that Hetherington did not think of highly organized competitive games being introduced into his program of four or five hours daily physical activity.

It would seem, after the inspection of some rather accurately secured data, that there might be a considerable difference between the effect a program of competitive athletics might have on a group of boys and the effect a program of directed non-competitive activities might have on another group of boys of the same age, or on the same boys.

In Cleveland we found boys competing in athletics did not gain as much in height, weight, and lung capacity as did a comparable group of boys in the same school not taking part in the competitive athletic program. Your attention is directed to Table I which gives you the simple average (mathematical mean) figures for the two groups. These figures tend to bear out the statement just made to the effect that boys taking part in athletics do not increase as much in

CUT, STOP, REVERSE AND DRIBBLE

Player cutting for the basket on a diagonal finds guard too close to permit safe shooting or dribble on in the original direction. Concealing his intention as long as possible in order to draw guard over to the right, the ball-receiver quick-stops, body-sways in the original direction, then deftly pushes off in the opposite direction, clearing the over-shifted guard to the left side. (From a high-speed moving picture of natural action by Owen Reed.)

height, weight, and lung capacity as do their schoolmates not taking part. Now, there may be a variety of reasons for this finding, and it is also possible that were the study to be made again over a similar length of time, the findings would not repeat themselves. We, however, have considerable faith in the integrity of the data presented and, therefore, in the findings illustrated in Table I. The groups of boys compared are small, being only about thirty in each group, but they were compared over approximately the same two-year span — namely from age 13 years 6 months to 15 years 6 months.

TABLE I

	Group 1 Athletes	*Group 2* Non-athletes
Height increase.....	1.27 in.	3.06 in.
Weight increase.....	17.75 lbs.	18.65 lbs.
Lung capacity increase.....	21.00	45.00

Table I shows the relative gains of the two groups over the same two-year age period, from 13 years 6 months to 15 years 6 months. The boys at the beginning of the study were found to be related as follows:

The average height of the athletic group was 63.7 in., the average weight was 112.4 lbs. The non-athletic group was found to have an average height of 62.6 in., and an average weight of 116 lbs. That is, the athletic group was, on the average, an inch taller and 3.6 pounds lighter per boy than was the non-athletic group.

So much for the data confirming the observations of Aristotle and Robertson. Let's now turn our attention to some data confirming Hetherington's contention.

Now then, in one of our junior high schools—Thomas Jefferson to be exact—all of the incoming 7-B boys were divided into two as nearly as possible equivalent groups. One of the groups was excused entirely from taking physical education. The other group was required to take physical education five days a week. In the beginning, the two groups were evaluated as shown in Table II:

Cleveland study shows students in athletics gain less physically than non-athletic group

TABLE II

Comparison of groups on the beginning of the experiment

	Group 1 Gym	*Group 2* Excused
Average height	59.5 in.	59.5 in.
Average weight	90.4 lbs.	88.1 lbs.
Average age.....	13 yrs. 1 mo.	12 yrs. 11 mo.
Average grades that half year	76.3	76.3

Any one having a knowledge of conditions in any given school would admit that these two groups of boys were entirely comparable groups at the beginning of the experiment. The data herewith presented in Table II represent the conditions of these boys as of February 1, 1933. In June of the same year, the two groups were found to have increased in the three aspects of lung capacity, height, and weight by appreciable and measurably different amounts. Table III gives the average gains made by the two groups.

TABLE III

	Group 1 Gym	*Group 2* Excused
Increase in lung capacity.....	16.2	10.1
Increase in weight.....	4.9 lbs.	3.8 lbs.
Increase in height.....	.99 in.	.93 in.

These data were treated statistically by means of the formula developed for calculating "The reliability of an obtained difference"—Formula 19 found in Garrett's "Statistics in Psychology and Education"—the following results were obtained:

It was discovered that the likelihood of the boys in this experiment who took physical education increasing in weight more than those who did not was 97 out of 100; that 92 times out of 100 increase in lung capacity would be in favor of those boys who took physical education; and that 96 times out of 100 those boys who took physical education would increase in height more than those who did not. There were in this study 51 boys in Group 1 taking physical education, and 46 boys in Group 2 excused from physical education.

The next study was with boys entering senior high school in grade 10-B and extending over the entire school year of 1932-33. These boys were divided into three groups—namely, boys excused from gymnasium, or Group 1; boys who took no directed exercise in the school except swimming, or Group 2; and boys who took a regular prescribed gymnasium program of two double hours of physical education per week, or Group 3. Table IV gives the results in terms of average increases in the three items mentioned over the period of one school year:

TABLE IV

	Group 1 124 boys (excused)	*Group 2* 89 boys (swimmers)	*Group 3* 128 boys (gym)
Lung capacity	15.2	19.9	22.5
Weight.....	7.47 lbs.	6.73	8.9
Height.....	1.007 in.	1.05	1.18

These results again bear out the results of the other studies. They show that those boys who took regular gymnasium work exceeded in average increases in height, weight, and lung capacity those boys who took swimming. In turn, those boys who took swimming exceeded in average increases in height and lung capacity those boys who were excused from gymnasium work.

Your attention is called to the fact that the boys who were excused from physical education gained more in weight than did the boys who took swimming. This, it seems, might easily be explained by the fact that swimming is known to be a reducing exercise.

The data presented, then, began to show that Aristotle, Robertson and Hetherington might all be right in their statements. That is, from Table I the information is secured that the non-athletes made favorable gains in height, weight, and lung capacity increases over a two-year period as com-

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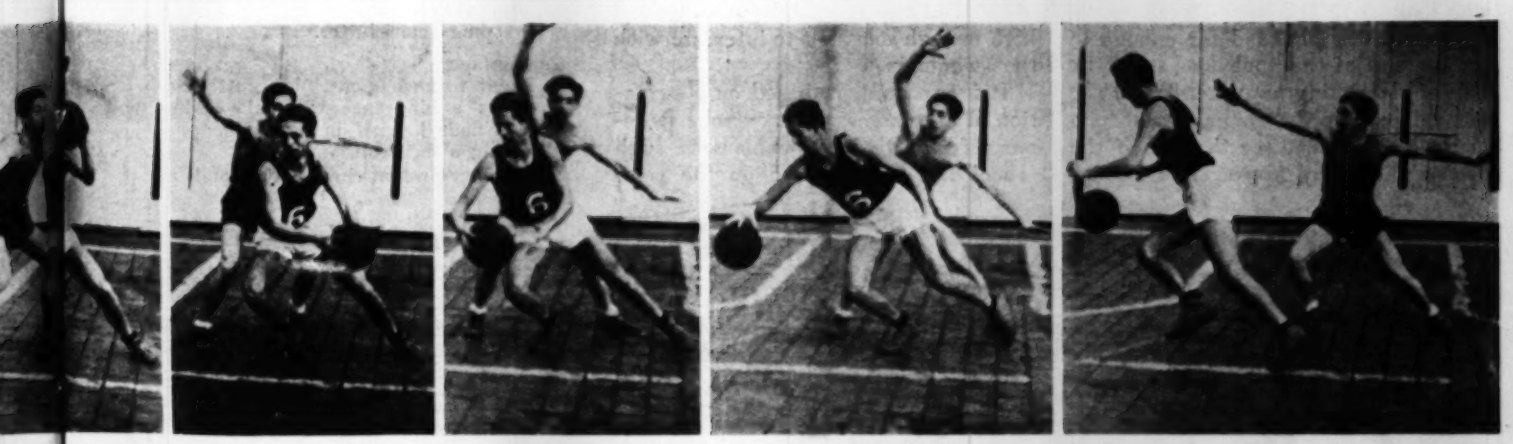


THE BACK STROKE RACING TURN

By Albert W. Gray

The author recommends the Spinning Turn as the most efficient for this stroke

This is the third of a series of articles on competitive swimming by the coach of the New Haven, Conn., High School swimmers. Mr. Gray's fourth article will be on the breast stroke racing turn, and will appear in the March Scholastic Coach.

THREE types of back stroke turn are in more or less common use by competitive swimmers, and the users of each type vary considerably among themselves in the matter of carrying out certain details of technique. The three types are generally known as the Spinning Turn, the Roll-over Turn, and the Somersault Turn.

The Official Intercollegiate and Interscholastic Swimming Rules (No. 91R, Spalding's Athletic Library; American Sports Pub. Co., New York, 25 cents) restrict the turn of the back stroke swimmer as follows (Rule X):

"Any competitor turning over on his breast before his foremost hand has touched the end of the course for the purpose of turning or finishing shall be disqualified."

So, a back stroke swimmer's first aim in approaching the turn is to make the touch while he is still on his back. One of his most difficult tasks is to judge his distance from the end of the pool. The free style and breast stroke swimmers have a decided advantage over him by being able to look ahead of them if they desire, with relatively little loss of time (no loss for the breast stroke swimmer, and a variable amount among the free style swimmers who look up). The back stroke swimmer who turns his head far enough to see the end of the pool does so at the risk of slackening his pace. There are some experienced swimmers who can turn their heads to see the end of the pool without any appreciable loss of time, as far as can be determined. Others follow the markings on the side of the pool and judge their approach to the turn almost exclusively from these; or they follow "landmarks" on the ceiling; or count the number of electric lights, windows in the skylight, girders, or whatever else is fixed above that might serve as a guide.

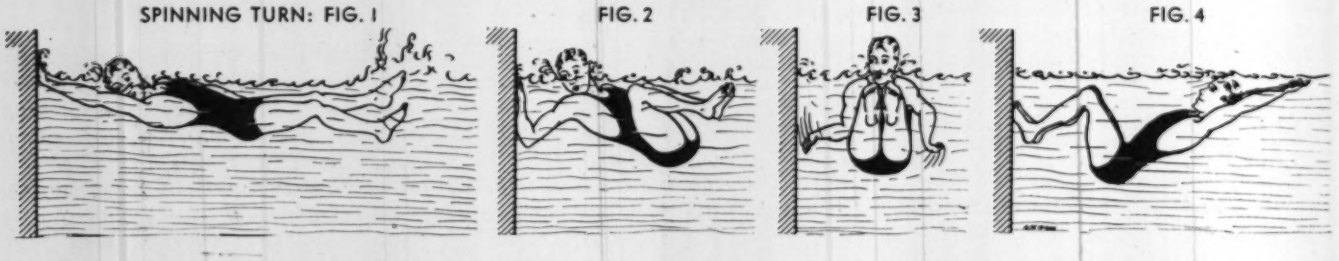
Even better than these incidental or "structural" aids would be deliberate markings on the ceiling made solely for the benefit of guiding back stroke swimmers. There are lane markers with T-shaped ends five feet from the walls on the tile bottoms of pools, so why not lane markers on the ceiling? A line painted across the ceiling directly above and parallel to the end, supplemented by a double line five feet inside it, would be sufficient for signalling the turn to back strokers.

Still another aid would be white flags placed on both sides and at both ends of the pool. A simple wooden standard about two or three feet high, with a foot and a half square piece of white cloth tacked to it, could be made by one of the boys. Four of them would be necessary. They could be placed in position just before the back stroke event and removed immediately after.

A rope stretched across the pool with tell-tale flags suspended from it is another device which would help. It, too, should be placed five feet from the end of the pool and be suspended high enough so as not to interfere with the swimmers.

It is my opinion, based on observation of all classes of back stroke swimmers from Olympic winners to high school last-placers, and on the comparative tests I have made on high school swimmers who were equally at home in making all three types of turns, that the spinning turn is the most efficient. It seems to be gaining new adherents all the time at the expense of the roll-over turn which perhaps still is the most widely used type in high school swimming. I can only speak from what I have seen of high school swimming around New England. The somersault turn is no doubt the least used, not because it is not an efficient turn in itself, but because it requires some degree of acrobatic skill and an exceptionally well developed sense of balance and direction. I have seen green somersault-turners come out of their "turn" and start swimming for the side of the pool until they crashed into a swimmer in another lane.

SPINNING TURN: FIG. 1 FIG. 2 FIG. 3 FIG. 4



In my opinion the advantages and disadvantages of each of the three types of back stroke turns are as follows:

The Spinning Turn

Advantages.

1. Most efficient; requires less time to turn.
2. Possibility of disqualification eliminated.
3. Rhythm of stroke not broken by turning over on stomach.

Disadvantages.

1. Difficulty in teaching it when swimmer has mastered another type.

The Roll-over Turn

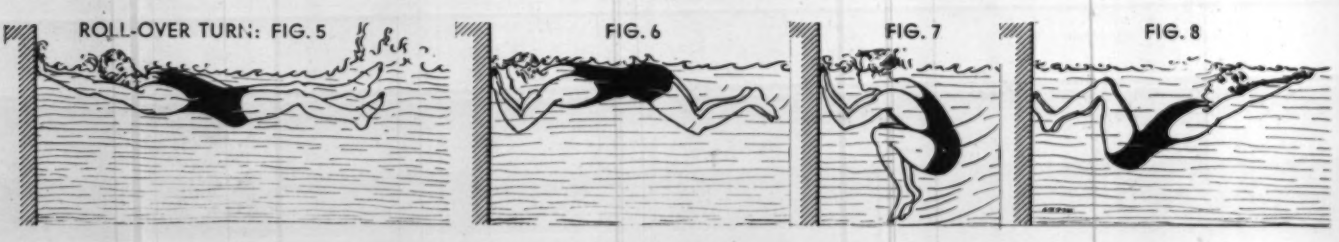
Advantages.

1. Questionable assistance gained by grasping scum-gutter.

Disadvantages.

1. Habit formed of grasping gutter becomes a hindrance when the swimmer finds himself in a strange pool having a flat wall.
2. The ever-present chance of disqualify-

ROLL-OVER TURN: FIG. 5 FIG. 6 FIG. 7 FIG. 8



ing by turning over on the breast before touching the wall.

3. Takes more time to execute than other types.

The Somersault Turn

Advantages.

1. Possibility of some individuals being able to do it more rapidly.
2. Questionable advantage in pleasing the spectators with acrobatic stunt.

Disadvantages.

1. Required acrobatic skill.
2. Bewilderment caused by performing complicated movements.

Various stages of the spinning turn are represented by Figs. 1, 2, 3, and 4.

It is wise for the swimmer to glide into the turn rather than to strike it hard enough to injure himself. As the hand touches the wall he should allow the elbow to bend until the head almost touches the hand. At the same time, the knees are brought to the chest, the legs kept below the surface of the water (Fig. 2). Assuming that it was the right hand which touched the wall, the next step in performing the turn is to pull forward through the water with the right hand and pull backward with the left hand (Fig. 3). If the left hand should touch the wall it pulls forward and the right hand pulls backward. In the first case the body will rotate, pivoting on the back, in a clockwise direction. In the second case the body will rotate counter-clockwise.

Continuous steps in performing the roll-over turn are represented by Figs. 5, 6, 7, and 8.

As the hand touches the wall the elbow bends and the body rolls over on the stomach (Fig. 6), the roll over onto the stomach being accomplished while the body is still in the lay-out position, although swimmers vary as to the bend in their knees while the roll is being negotiated. The roll is done with a very quick movement: one hand, extended overhead, touching the wall with the other hand 180° away from it and at the hip, is suddenly brought diagonally over the body above the water. When the hand has completed the forward swing to contact the wall, the body has rolled completely over on the stomach and the knees are beginning a rapid bend in order that the feet may be brought forward for the push-off. For the knees to bend perceptibly before the body rolls over is to add resistance to the roll.

Some back stroke swimmers claim an advantage in the use of the roll-over turn in being able to grasp the scum-gutter and thereby anchor the body so that the legs may be rapidly pulled through to the position where the feet may be placed on the wall for the push-off. This becomes a disadvantage when the swimmer finds himself in a pool where the ends are a flat wall, there is no gutter for him to grasp and he becomes confused at not being able to go through his usual movements.

The only possible benefit to be gained from the use of the somersault turn is when a swimmer can perform it more rapidly than some other types. Weak points in this turn are easy to recognize when we attempt to teach it.

"Mickey" Cochrane, Mgr. Detroit Tigers, Champions of the American League in 1934, has always used and endorses Louisville Sluggers.

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THE BUTTERFLY BREAST STROKE

By John J. Ferguson

The new stroke, with its above-water recovery, is now universally legal

THE butterfly breast stroke, in which the arms are kept straight (elbows locked) at all times and brought out of the water for the recovery of the stroke, is now universally recognized as a legal breast stroke. At the Miami convention of the A.A.U. in December the wording of the breast stroke definition was changed so as to relieve the definition of the ambiguity which admitted of several interpretations. The National Collegiate Athletic Association had previously altered the wording of the rule, and in the 1935 edition of the N.C.A.A. Intercollegiate and Interscholastic Swimming Guide we find the new wording:

"Both hands must be *moved* forward together and drawn backwards simultaneously."

The verb in the old rule was *pushed*, and was generally interpreted to mean that the hands and arms had to go through the water on the recovery. The verb *moved* has now been substituted for *pushed* by the A.A.U. and the N.C.A.A. as a specific recognition of the legality of the type of breast stroke that has come to be known as the butterfly stroke. The Federation Internationale Natation Amateur, world governing body which controls Olympic rules, had previously ruled that the breast stroke rule in its original phraseology permits the use of the butterfly style. However, there is a strong feeling abroad for changing the rule after the 1936 Olympics to prohibit the butterfly style, which at present is not looked upon with favor by European swimming leaders.

High school significance

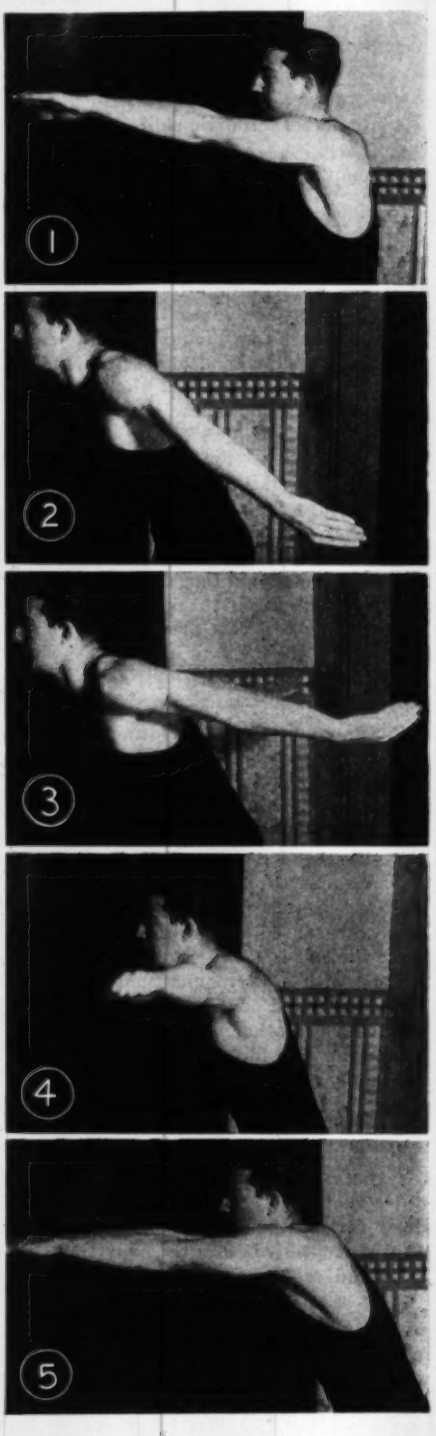
The butterfly stroke should be of particular interest to high school coaches and competitors, because its value as a speed-producer is mainly in distances 100 yards and under. The breast stroke event on the high school program is at 100 yards: on the college program it is at 200 yards.

The explanation of the increased speed derived from the butterfly stroke lies in the greater physical power that is derived from a movement which employs a different group of muscles than are called into play in the old-style stroke. The muscles of the breast are mainly used in the old-style stroke, while the butterfly stroke employs also muscles of the side and back. Thus, the new stroke demands greater physical effort, which, so far, has been found to be too much to permit improved performance in distances over 100 meters. However, Matt Mann, coach of the University of Michigan swimming team, has expressed his belief that with the proper training his team will be able to use the butterfly stroke for the intercollegiate distance of 200 yards and show better time.

The butterfly breast stroke is a recent development in competitive swimming. Since 1931* it has appeared from time to time, being admitted as a legitimate stroke in some local meets and barred from others where its use was attempted. A high school boy, Henry Meyers, a member of the swimming team of Erasmus Hall High School, Brooklyn, New York, is said to be among the first to have used the stroke in the East. Given to experimentation in the water, he was trying out gloves with webbed fingers when he was not probing the possibilities of a new stroke. In 1931, while practicing the breast stroke turn in which both arms are flung out of the water—giving the swimmer the appearance of leaping to the end of the pool, he was attracted by the force and speed with which this stroke sent him forward, and began using the stroke while swimming along in the pool. He noticed its possibilities and continued its use.

There is a claim that the aquatically famous Spence brothers—Leonard, Wallace and Walter—were the first to use the stroke in actual competition. At any rate, they are credited with having developed the stroke to the point where others began taking an interest in it and making test performances with it to compare with their best times with the orthodox stroke. In the fall of 1932 Lester Kaplan, of the College of the City of New York, made appreciably better times in every test he made of the butterfly stroke over the shorter distances—100 meters and under. While he was not permitted to use the butterfly stroke in intercollegiate competition at that time, he gave exhibitions of the stroke in various metropolitan pools, hanging up record upon record.†

Paul Friesel, a teammate of Kap-



Lester Kaplan of New York, who has been conspicuously successful with the butterfly breast stroke in the East, demonstrating the new stroke from a stand-up position out of water. In executing the stroke the hands and arms, kept straight, are pulled down in an arc toward the hips, and drawn back until the palms of the hands are even with the surface of the water. The arms are then quickly shot forward, skimming over the surface of the water. The arms are held straight throughout the entire stroke, thus giving the stroke the appearance of flapping wings.

*The butterfly stroke appeared in Europe about this time, or perhaps earlier.

†Since this article was written John Higgins, using the butterfly stroke, broke the American record for 100 yards and the world's record for 100 meters, at Providence, R. I., Jan. 11, 1935: Brown University vs. Alumni, intercollegiate long course. See records table on page 22.—Editor

lan's, national junior A.A.U. breast stroke champion, improved his best time for the 100 yards by five seconds by using the butterfly. Friesel and Kaplan have given the most notable performances with the new stroke, although their best times are soon likely to be bettered now that the stroke is universally legal. Kaplan's records with the butterfly, made in A.A.U. sanctioned meets, are unofficial, because the A.A.U., in recently recognizing the stroke, decided not to entertain claims for past performances.

As far as the writer knows, there are few women who are able to use it and still reduce their present time, but there is no doubt that once they get the knack of doing it, they will soon be able to match their brother swimmers in reducing their own records.

Stroke technique

The position of the body and the coördination of the arms, legs and breathing are the same in both the new and old styles. The arm movement may be divided into three parts, beginning from a gliding position as in the top photograph. No. 1.

Arms

1. Both hands are pulled down together in an arc toward the hips, and drawn back until the palm of each hand is even with the surface of the water as in pictures 1 to 3.

2. The thumbs are then turned down and away from the body.

3. Both arms are quickly brought forward, skimming above the surface of the water as in pictures 4 and 5. The arms are held straight throughout the entire stroke. There is no bend in the elbows as in the orthodox stroke.

Legs

The frog kick is used just as in the old stroke, the leg drive coming as the arms are brought forward. The kick is started when the arms are in the position of picture 4.

Breathing

There is no difference in the method of breathing in either stroke; the swimmer inhales as the hands are pulled down and exhales as the arms are shot forward between pictures 4 and 5.

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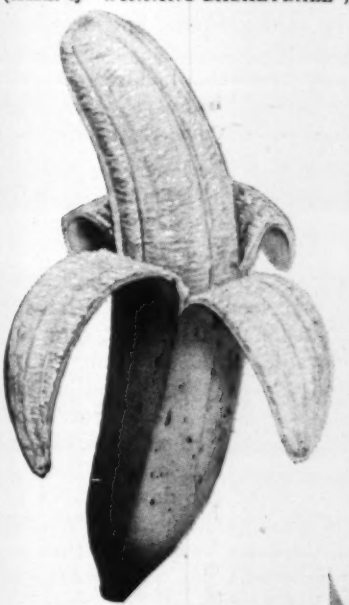
Nat Holman

Basketball Coach, College of the City of N. Y.
(Author of "WINNING BASKETBALL")



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What is too much exercise?

[Continued from page 17]

pared with boys in athletics. Tables III and IV tend to show that the boys who took directed exercise made favorable gains when compared with those who were excused from the physical education requirement. Aristotle and Robertson considered the cases of boys in the athletic group as compared with the non-athletic group (Table I). Hetherington, on the other hand, was without question directing his remarks to the groups represented by Tables III and IV. (Tables on page 17).

The single question comes up as to why the difference: that is, why do boys competing in competitive athletic programs—thereby getting a larger dosage of physical exercise than do their schoolmates—fail to gain as much in height, weight, and lung capacity when boys who take the required physical education program also gain in height, weight, and lung capacity over that group of boys who are excused from the required physical education activities? This seems to be a fair (even if long) question. It is one to which you may have an answer fully as good as the one being put forth in this paper.

I cannot help but feel that it is not the item of physical exercise in amount or kind that causes the difference. My personal feeling is that it is the matter of the psychological concomitants accompanying the program of competitive athletics—and which are almost entirely lacking in the regular program of physical education—which has to do with the difference.

All of us are familiar with the ordinary symptoms of the athlete preparing for competition. Lucky is the athlete who can escape the tensions which are set up by the competitions. I have never seen an athlete who did not give evidence of the fact that for a considerable period of time before any stated athletic competition he was in a state of nervous excitement. Further, that this state of nervous excitement—or nervous tension, call it what you will—caused the derangement of certain of his bodily functions. We are all familiar with certain of the so-called phenomena due to nervous excitement before competition—the dry mouth, the loss of appetite immediately before, looseness of the bowels, necessity for frequent urination. I believe that it is this interference with the bodily processes by the psychological factors of excitement or what-not entering into the competition which make for the difference between proper stimulation of the functioning of the organism due to proper exercise and the interference with their proper functioning brought about by the highly competitive contests.

In other words, if boys could compete with one another without the pressure put upon them to win for the school, without the nervous excitement imposed on them by playing before audiences, and without the setting up of an artificial situation, that the competitions would be good. In other words, boys do compete against one another at all times, but informally and without excessive excitement, and these informal competitions are without question good for them. It is only when the coach is introduced who has a desire to win, and when the pressure of partisan spectators makes itself felt, and the competition is taken out of its proper setting—that of a natural, everyday thing—that the bodily processes of the contestants are interfered with.

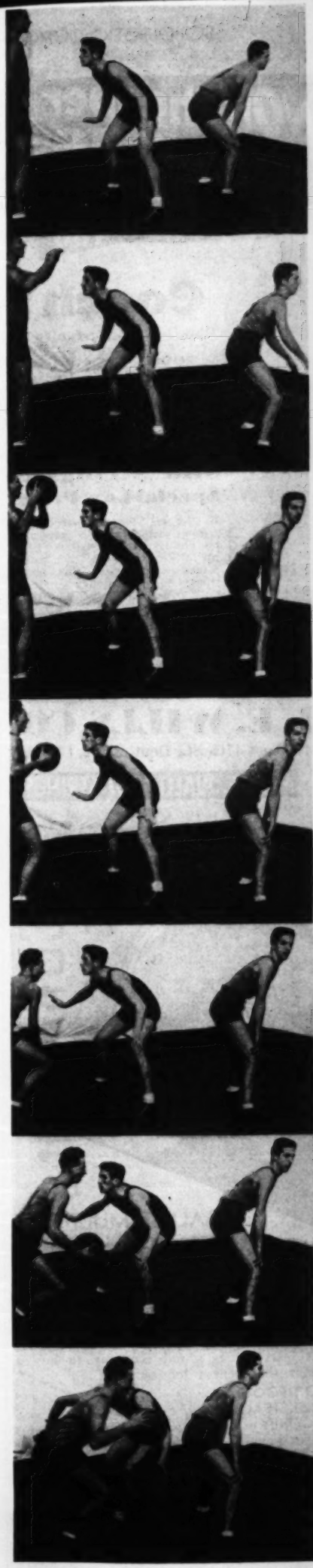
Let no one reading this article get the entirely erroneous idea that it is a plea for the abolishment of inter-school athletics. Such is not the case—far from it. Inter-school athletics have proven their values in too many ways. But, as with the eruption of the sixth year molar, the appearance of the beard, and the right to vote, there is a proper time and place for athletics in the school physical education program. This article simply raises the question as to where its proper place may be.

Boys in general certainly have an accelerated period of growth corresponding rather closely to the junior high school age—roughly, twelve to fifteen years. During this accelerated period of growth, everything should be done to clear the path of any and all obstacles which conceivably might interfere with it. Boys of this age are required to make physiological and psychological adjustments which, to say the least, are important.

If it is only suspicion, then, that inter-school athletic activities fail to make these adjustments the more easy, not to mention interfere with them, they (inter-school athletics) should certainly be held in abeyance until these adjustments are completed.

It would seem, then, that the proper time for the inclusion of the inter-school competitive games in the program of physical education could be arrived at rather easily—at least from the standpoint of logical deduction.

It seems perfectly logical to sup-



pose that after boys have physiologically matured, organized inter-school competitive athletics might be safely introduced into their program. It also seems somewhat reasonable to think that through the junior high school life of boys, the teaching of game skills to be used in the future in the senior high school athletic program might well be taught. Further, intramural contests of all sorts might well be organized for those boys who desired to take part in them, care alone being exercised that these boys be not allowed an excessive amount of time for games as against the learning of the game skills involved.

Dr. T. Wingate Todd and Dr. W. M. Krogman of Brush Foundation, Western Reserve University, have advanced a possible explanation of the facts revealed by the data of Table I. Neither of the men mentioned care to be quoted beyond conjecture in this matter. Their best opinion, however, is about as follows:

It is possible the boys choosing to compete in the athletic programs are boys who have more nearly matured than are the boys who did not choose to take part. In other words, desire to compete and physiological maturity may have a high positive correlation. Lack of physiological maturity and desire to compete may then have a low or even negative correlation.

The truth or falsity of Drs. Todd and Krogman's supposition requires several years of experimental study to determine.

In general, however, one thing seems quite certain and that is before boys should be permitted to take part in any inter-school competitive athletic program, either junior or senior high school, the boys should be required to show evidence of some considerable degree of maturity. At the present time, there are no definite or suitable measures of maturity easily available. General appearance probably is as good and as safe a means as any other. Experienced teachers catalogue boys almost at a glance in regard to this matter of maturity, particularly those teachers who have the opportunity to see boys in the process of taking showers. It seems a perfectly safe statement to make that boys even in senior high school who have smooth skins, whose muscles have not yet become marked or chiseled, but whose arms and legs are round and full rather than marked by muscle contour, should be kept out of competitive athletics. True, there are other signs. The appearance of hair on the face and body, change of voice, and, as before stated, the entire general appearance of the boy should be the thing upon which every properly trained teacher of physical education should depend for guidance in regard to permitting the boy to take part in the competitive athletic program.

As said before, you may have an entirely different answer to the question as to what makes the difference between the effect upon boys of ordinary physical education as opposed to no physical education, and of competitive athletics as opposed to no athletics. At any rate, your attention is called to these situations with the hope that you will give them your time, thought, and possibly devote some time to research along these lines.

Research in these matters is not an easy thing because of the many variables which enter into the situation. Care must be taken to see that the groups which are to be analyzed are comparable at the beginning of the experiment—otherwise the validity of the experiment will be in serious question and, in all probability, your time and efforts will have been lost.

■

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Baseball

[Continued from page 15]

Pitchers should take nothing for granted. I have discovered, much to my sorrow, that the batter who could not hit a curve ball with a snow shovel in April is able to murder one later in the season. For that reason I make it a practice to study all opposing batsmen even when I am sitting on the bench and try to see what they are or are not hitting so as to be governed when I tackle the same hitters.

Carelessness on the part of the pitcher crops up in diverse forms. The pitcher should always be on guard against it, and should realize that it is just such lapses in sustained drive and fixed attention that cause pitchers, who have been going along beautifully for a few innings, to blow up all of a sudden.

We are all familiar with the pitcher who issues an intentional pass to a dangerous batter, preferring to take a chance on the following batsman who is regarded as less formidable, only to see the latter crack out a ringing single or better. If the real reason for this unexpected hit could be traced I believe it would usually be located in the momentary letdown in the pitcher who mentally had prepared himself for an easy batter. He figured he had got the tough batsman out of the way and had something soft to work on. In other words, he failed to bear down and lost a ball game as a result.

On the other hand, coach your pitcher not to be discouraged just because some weak batsman has riddled his curve or fast ball for a long hit, causing him to think his curve or fast ball, whichever one it might be, is not breaking well. Along this line I remember George Earnshaw telling me that Connie Mack used to tell his pitchers, in such cases, that even a player whose batting average was only .083 might get a hit now and then by happening to swing just where the ball was coming.

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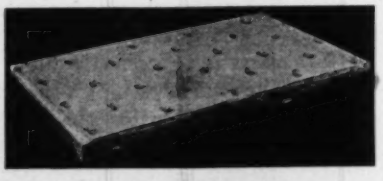

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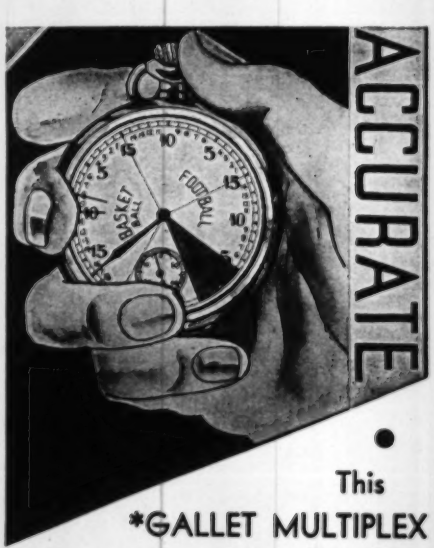

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Mechanics of Running

[Continued from page 10]

tance and distance method which has gradually been developed as the most economical for longer runs. It is characterized by 1) a long swinging stride 2) Landing on the heel 3) High kick-up behind and easy recovery of the leg 4) Forward thrust of shoulder and hip with some trunk rotation on the side of the driving foot at the time of the push 5) Arms swung across in front of chest and close to it but somewhat wide from the body on the back swing, allowing good chest expression and easy swing of the body from side to side.

The stride style is interesting because the action permits the calf muscles to stretch more just before pushing. Landing on the heel takes some of the stress off of these muscles and prevents their tiring so soon. The arm action stresses freedom of the chest and a swing which not only helps the push but shifts the weight very naturally to the other foot. This style is said to have begun with Kolehmainen. Nurmi accentuated the hip swing, the arm swing and improved the body carrying. This method has made the Finns the greatest distance runners in the world, coupled with their diet and training methods.

A splendid German article by Dr. Klinge[16] champions the step style as opposed to the stride style. There is no doubt that the step style is more successful for sprinting. It is characterized by more body lean, the body is up on the toes, the arm action is more a forward and backward piston action and the leg is recovered as fast as possible with high knee action. The principal point made for the step style is that the legs drive backward and under the body without the retardation encountered by landing with the leg too far in front of the body. The differences in mechanics are shown in Illus. VI (on page 10). (a) Shows how the stride is changed by landing on the heel (stride style) or on the toes (step style). (b) Shows the reaction thrust upward and backward acting to check the body and create one type of ground friction. (c) Shows the step style with the retardation component eliminated.

[16]Klinge, Dr. Erich, "Und doch Ballenlauf," *Die Leibesubungen*, Feb. 1925, pp. 61-67.

Studies of W. O. Fenn, of Rochester. Dr. Wallace O. Fenn[17] has contributed two brilliant studies on the mechanics of running. The first of these was published in 1929 and deals with the frictional and kinetic factors in the work of sprint running. By means of moving pictures measurements were made of sprinters to show that the kinetic energy of the limbs coupled with the upward and downward movements of the center of gravity, ground friction, back pressure and wind resistance account for a large part of the total energy expended. An average sprinter is shown to expend a total of 13 horsepower while he is turning out mechanical work at the rate of 2.95 h.p. which is equivalent to an efficiency of 22.7%. This is accounted for in the following manner:

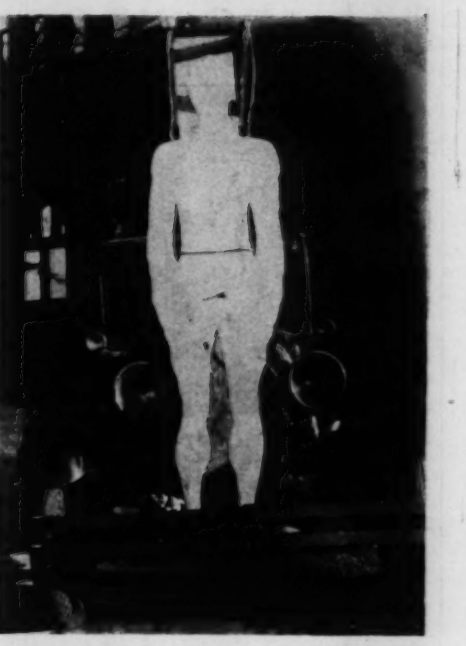
Changes in velocity	0.5 h.p.
Acceleration of limbs	1.68 h.p.
Deceleration of limbs	.67 h.p.
Work against gravity	.10 h.p.

The second of these studies deals with work against gravity and work due to velocity changes in running. The movement of the center of gravity within the body due to changes in position of the limbs was determined. The center of gravity was shown to rise 2.9 cm. after each step due to the combined action of arms and legs. The total rise was 6 cm. The retardation component at the time the foot contacted the ground was measured with a special apparatus which made graphical readings. The forward pressure (retardation) on the ground accounted for a loss of .34 h.p. due to checking the forward velocity. The wind resistance was estimated as accounting for .16 h.p. The loss of velocity when the foot contacted the ground was 13 cm./sec. When calculated by vector analysis using the velocity of the center of gravity and the angle of contact with the ground it was 12 to 24 cm./sec.

Experiments on Wind Resistance at Springfield College. The writer experimented with wind resistance at Springfield in 1931.[18] A wooden model of a man was cut out and mounted on the front of a car. A scale was attached to this model

[17]Fenn, W. O., "Frictional and Kinetic Factors in the Work of Sprint Running," *Amer. Jour. of Physiology*, April 1930, pp. 583-610; "Work Against Gravity and Work Due to Velocity Changes in Running," *Amer. Jour. of Physiology*, June 1930, pp. 433-462.

[18]Cureton, T. K., "Measuring Air Resistance in Running," reported by T. R. Brining, *The Athletic Journal*, Feb. 1931.



Illus. VII

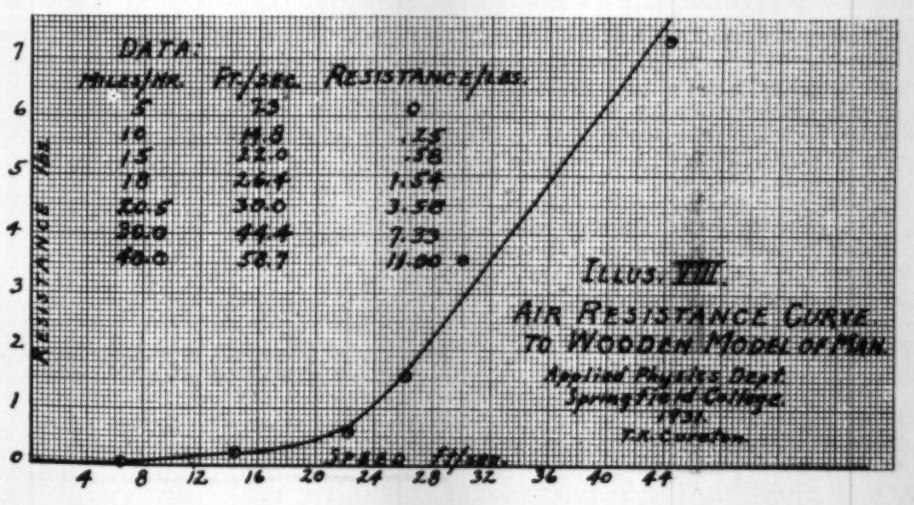
to record the pressure of the wind against the apparatus. (Illus. VII).

The car was run back and forth on a flat paved road well sheltered by houses on a windless day. Different speeds were tried time and again and the wind pressure recorded. Results were obtained which are not exactly the same as for the human body running but represent closely such a situation. Illus. VII shows the resistance of air curve which was obtained.

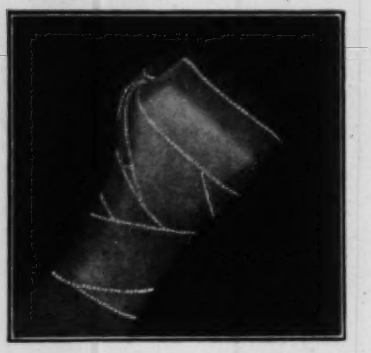
Corresponding to the 100 yard dash speed, the wind resistance would be approximately 3.58 pounds. This amounts to 2.8% of the propelling force when estimated as .8 of the body weight. Since the speed of the runner is directly proportional to the propelling force, it can be calculated that the runner would be slowed up .28 sec. With a 30 mile per hour breeze in his face the slowing up would be .57 sec., and if at his back, a 10 sec. 100 yard sprinter might run the distance in 9.43 seconds. This emphasizes the need for officials to take wind conditions into account when considering applications for records.

Pace as a Mechanical Factor. A rapid change of pace is exhausting. This is due to the fact that the body must be accelerated and, to do this, inertia must be overcome. It requires force to overcome inertia. This is nothing but waste. Nurmi is credited with having made an exact study of pace and ran evenly to eliminate such waste. This is one factor beyond a doubt in his marvelous records. Kennelly,[19] of Harvard, made a study of speed in racing animals and came to the conclusion that the principal factor governing the time made in a race was the speed at which the race was run. The faster the speed the quicker the fatigue. It would be proper from the mechanical point of view to set a pace from the beginning which would be the pace required to carry a man the selected distance at an even rate of speed. This should be as fast as the state of organic condition permits.

[19]Kennelly, A. E., "An Approximate Law of Fatigue in the Speed of Racing Animals," Proceedings of the American Academy of Arts and Sciences, 1906, vol. 42, p. 275.



"HANDS FIRST"



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Wisconsin Replies

[Continued from page 11]

are at times negligent on this point.

The Wisconsin I.A.A. began an intensive study of athletic injuries some time before Prof. Eastwood began his effort. A study will show that for years Wisconsin reduced the time of the football period from that given in the National Collegiate A.A. rules, the only rules then available. Instead of the 15 minute quarters, Wisconsin high schools for years have been limited to 12½ minutes. This, we believe, has materially contributed to the safety of the Wisconsin game. The N.C.A.A. made no provision for shorter high school periods until recently. The National Federation made repeated suggestions relative to other pertinent changes, among which are a more liberal rule for substitutions, more timeouts and other requirements of definite benefit to boys of high school age. High schools made other efforts to have the N.C.A.A. rules give some consideration to the growing boy of high school age, but to no avail. This failure on the part of the N.C.A.A. to consider in the making of playing rules 80 per cent of those playing the game compelled eight states to join in the making of their own football rules for the boys in their charge. This movement is spreading and will lead to a still safer high school game.

Wisconsin, since Sept. 1, 1930, has recorded every football injury. The Wisconsin results are not the somewhat uncertain information resulting from questionnaires. Rather are the Wisconsin totals the results of the Athletic Accident Benefit Plan, developed, operated and financed by the State Association, and under which high school boys have, to date, been paid $40,000 in benefits. The Wisconsin figures are definite and are being utilized in the development of a game as safe as it can possibly be made for the boys and as interesting as possible for the spectator.

The changes made in the high school regulations by the National Federation the last few years have maintained greater safety to high school boys, at least in Wisconsin where figures are definite. While it is impossible to base a final conclusion on one year of playing the trend is clearly indicated and it is fairly safe to assume that the change in the forward pass rule made for the past season has definitely contributed to a safer high school game.

Wisconsin has not had a high school football death in years. Records show no death since 1915. No definite information on this score is available for 1915 and earlier years and for that reason no positive statement can be made previous to 1916.

The following is a tabulation of the number of boys competing in Wisconsin high school football during the years covered by the Eastwood study:

1931	1932	1933	1934
14,989	12,954	14,782	14,840

During these same years other schools, parochial and private of high school rank, added an average of at least 10 per cent to the public school total.

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FEDERATION FOOTBALL RULES CHANGES

Forward Pass Feature Is Retained

THE forward pass rule by which a pass may be made from any point behind the line of scrimmage, and the 15-yard side zone, will be retained in the 1935 football rules of the National Federation of State High School Athletic Associations, it was announced by H. V. Porter of Chicago, secretary of the Federation's Football Rules Committee. The Committee held its annual meeting in Chicago, Jan. 11 and 12.

The Committee's decision to retain these two rules, which were used for the first time last year by high schools, was made with the backing of a vote of 337 for the rule and 32 against it by interested high school football men throughout the country. A large majority of those receiving and returning the questionnaire were in the eight states which have officially adopted the National Federation football rules.

No major changes from the 1934 code were made for 1935, but there are numerous slight changes designed to bring the Federation rules into greater harmony with the rules of the National Collegiate A. A. The National Collegiate A.A. Rules Committee, however, does not meet until this month, when the N.C.A.A. rules may undergo changes on points of minor differences. The 1934 N.C.A.A. code permitted forward-passing only from points five yards and more behind the line of scrimmage, and called for a sideline zone ten yards wide.

The National Federation changes for 1935, designed to harmonize the Federation rules with the N.C.A.A. rules, have been made as follows: (The first figure refers to the *rule* number, the second to the *section* number, the third to the *article* number, and the fourth to the *item* number. The letters refer to the divisions under the *items*).

3-6-1-1-(a) relative to a time limit for the huddle is to be removed.

3-4-1-4 is to be enforced even in the case of the illegal touching of a kicked ball.

6-7-1-2 will make it clear that the ball is to be put in play on the in-bounds line after a fair catch in the side zone.

It was voted to retain the present rule relative to allowing a shifted linesman to return to the line during a subsequent quarter.

8-1-3-1 will prohibit snapping the ball to any player on the scrimmage line.

8-5-5-2. Penalty will treat an intentional incompletion behind the opponents' goal line the same as if it were a minor incompletion.

8-5-5-3. Penalty is to be changed so that a major incompletion behind the opponents' goal line will result in an option for B (possession of ball at previous spot or a touchback).

8-5-7. Penalty (1) is changed so that interference by A behind the opponents' goal line is an automatic touchback.

The committee authorized an interpretation which will eliminate certain evasions of the rule relative to who is the player on the end of the line where both hands are placed on the line with the body in a diagonal position.

Other Changes for Clarity or Safety

2-3-3. The matter of treating freak punts was left to the discretion of the editors. The kick mentioned in the note will be considered a return kick.

2-14-1, 5-A-3-3, 6-5-32 and 8-4-23 will be worded to harmonize with the change in connection with the accidental kicking of a punted ball.

2-19-1-2-(c). "Touches" will be substituted for "'recovers".

2-20-2-1. "From whom he takes it" will be substituted for "formerly in possession".

2-32. The definition of hurdle will be made to include the described action even if made by a player other than the runner.

2-3-3. The definition of clipping is to be reworded so that it will not apply to the use of hands on the back of a blocker by a player of the kickers who is attempting to ward off a blocker or get at the runner.

3-4-2-1. The matter of procedure in connection with substituting was left to the discretion of the editorial committee with power to act. Also, they were instructed to add a note recommending experiment with having the matter of substitutions taken care of by someone on the side line who would have authority to use a horn for attracting the attention of the nearest official.

4-4-3-1. A foul following an incomplete forward pass is an exception.

4-4-6. Provision for foul by opponents while guardians are in possession will be added.

4-4-7-1. The last sentence will be reworded for clarity.

4-4-8. A slight change will be made to be consistent with other sections.

5-A-1-4. A note is to be added to the unnecessary roughness clause which definitely commits the rules committee to the policy of providing further protection for the forward passer after the ball has left his hands.

5-A-2-3. Penalty is to be changed so that the spot of enforcement for running into a kicker who is behind his goal line will be the previous spot.

6-2-1-(f). "Touches" will be substituted for "strikes".

8-5-7 is to be slightly reworded so that it is clear that pass interference and eligibility rules are not meant to apply to passes which are clearly meant to be laterals but go forward.

9-2-1. Additional ways in which a touchdown may be scored will be listed.

9-3-2-1. Penalty for foul by A when they kick during a try will be the usual distance penalty for the foul instead of the loss-of-ball penalty for foul during a free ball.

It is to be made clear that the ball is automatically dead as soon as there is a touchdown.

When a punted ball is touched by A and goes into the end zone it is not automatically dead.

When a punted ball has not crossed the plane of the goal line but is touched by a player who has a foot or feet in the end zone it is not considered in touch until such time as it might cross the plane. Officials must use judgment and in case of doubt would probably consider the ball as having passed through the plane of the

If a backward pass by the guardians is batted into their end zone by an opponent and goes out of bounds from the end zone it is a safety.

A player who is in possession with his feet in the end zone and who touches the goal post is considered in bounds.

It was voted to make the wearing of headgear mandatory. The procedure relative to infractions is to be the same as that given in the penalty under 1-1-8-8.

6-2-1-(a) is to govern in case of questions relative to when it is permissible for a tackled player to throw a lateral pass. The same rules as apply to whether a fumble occurs before or after the ball is dead are to be used.

3-5-4 is to contain a note which will allow more liberal substitutions, provided there is mutual agreement.

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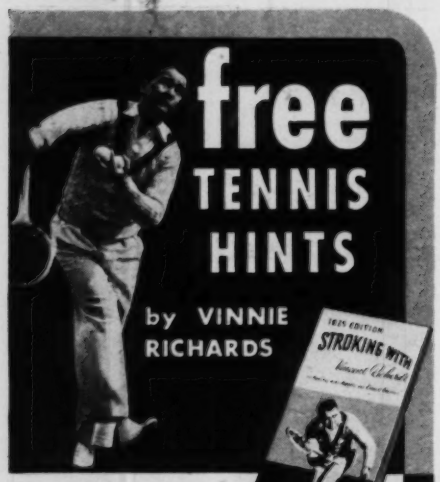

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Heart of an Athlete

[Continued from page 12]

to Dr. Knoll an acute dilatation of the heart may develop in weakened persons taking part in strenuous exercise without preliminary training. This can be verified through an X-ray examination.

In most cases it is probably a temporary defect and the heart comes to normal. The time necessary for a complete recovery varies with the age and condition of the individual. Dr. Rautmann described a case of a sixty year old man who developed a heart dilatation after some strenuous physical work. In the first two weeks of a complete abstinence from exercise, the transversal diameter of the heart decreased only .4cm, whereas in the following four weeks it dropped an additional .6cm.

Dr. Burns has shown that a fatigued heart is more stretchable than a fresh one. Dilatation of the heart increases its weakness, which is characterized by an increased diastolic pressure. The pulse after an overexertion remains accelerated for a long period of time. A weakening in the right half of the heart will result in the disappearance of the pulse during an inspiration. It also may lead to a faster breathing. Some writers believe that an extreme dilatation may lead to an insufficiency of the mitral valve (the valve between the left auricle and the left ventricle in this case does not close completely). The subjective symptoms are also of importance. Patients complain of a heart palpitation. Some complain of a pain in the cardiac area. The irritability of the patient increases. The work capacity is lowered. Drs. Deutsh and Kauf, noted for their thorough investigation of hearts of athletes, state that the heart once dilated has a tendency to dilate again.

"The Burnt-up Athlete"

This is a rather common expression with a very uncommon meaning. Summing up the different definitions of "burning up," we can condense them to the following symptoms. The burnt up person complains of a continuous feeling of fatigue, of lack of interest in studies, of irritability and pains in the chest. Also athletic performance is lower than before. These symptoms sound very familiar. If it is not chronic fatigue with neurasthenia, then we have a possible case of a dilated heart. Since the occurrence of the heart dilatation is rare, it is possible to conclude that in most of the cases, we are dealing with chronic fatigue and the only treatment necessary is a judicious rest.

Conclusion. The heart of an athlete due to a greater demand on the circulation is stronger and better developed than the heart of weaker sedentary people. The term Athletic Heart at present is misleading because it is used to denote a pathological change in the heart due to athletics, whereas it should connote "the heart of an athlete." Injuries to a sound heart due to athletics are very rare. A heart influenced by any previous disease may be harmfully affected by vigorous athletics and that is why medical supervision over athletics is desirable. A "burnt-up" athlete is usually an overtired athlete, and can be restored to normalcy by rest.

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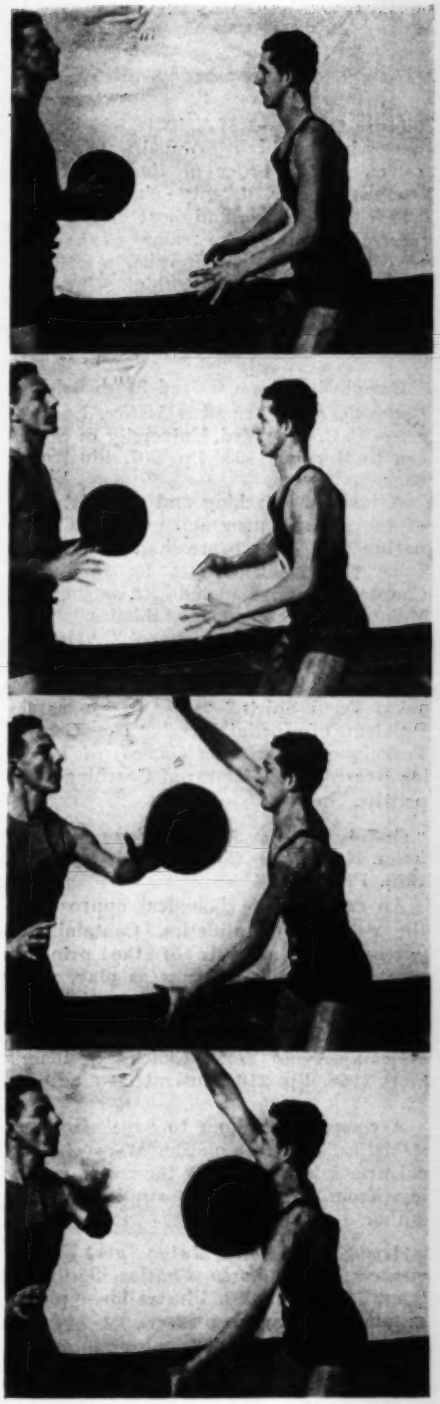
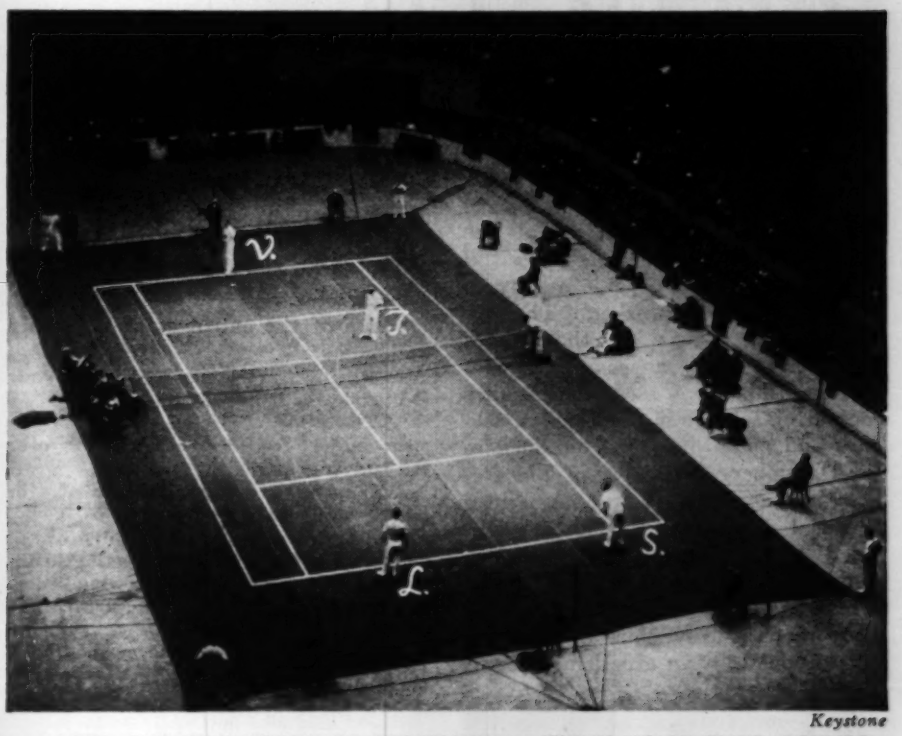


Owen Reed photos.

ABOVE — DECEPTION IN BASKETBALL PASSING: The passer, keeping a fixed gaze straight ahead, succeeds in sending a left-hand cross-body pass through the guard. One of the chief weapons of basketball deception is the ability to manipulate the ball successfully with either hand.



Keystone

ABOVE—THE "BIG FOUR" OF PROFESSIONAL TENNIS START THEIR ROUNDS: George Lott and Lester Stoefen, newcomers to the salaried ranks, facing Tilden and Vines in their match in Madison Square Garden, New York, which lasted more than three hours, Tilden-Vines winning, 3-6, 14-16, 13-11, 8-6, 6-4.

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ABOVE—THE TRIMMINGS OF HIGH PRESSURE COMPETITION BEDECK THE CHESS ARENA: The opening of play at St. Bride's Institute, Fleet Street, for the boys' championship of London.

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Over the Field

This department is conducted by Hyman Krakower, Ph.D., a member of the staff of the Department of Hygiene, College of the City of New York.

IT seems that the controversy between the athlete and non-athlete in relation to academic studies will go on forever and provide a fruitful field for research workers. The cry has often been raised that the athletes are poor students as compared with the non-athletes. A resume of studies comparing scholarship abilities of athletes and non-athletes is contained in the December, 1934, issue of *The Research Quarterly* of the American Physical Education Association, entitled "Athletic Ability and Scholarship," by Elwood C. Davis of Pennsylvania State College, and John A. Cooper of the New York State Penal Institution. It is an excellent piece of work.

Forty-one studies of high school and college athletes and non-athletes have been summarized involving over two hundred institutions over a period of thirty years from 1903.

At present "the issue is still not clean-cut because of such factors as a lack of agreement upon the definitions of athlete and non-athlete; disagreement over the validity of the tools used to measure scholastic ability; the unequal number of cases in the two groups in many studies; and charges and counter-charges of bias."

The general conclusions were that in most cases the non-athlete does slightly better work than the athlete, the differences, however, having no statistical value. The athlete has a better possibility of graduating with his class than the non-athlete. The athletes make better grades after the sport season ends. It is a question whether the athlete would rank higher than the non-athlete if he were motivated to raise the quality of his work during the playing season. It is possible that changes in methods of teaching and revised curriculums may stimulate the athlete to greater achievement.

Another study in the scholastic field of athletes and non-athletes was made by Harmon S. Jones of the Union High School at Grand Rapids, Michigan. His study also appears in the December, 1934, issue of *The Research Quarterly*. The study is entitled, "A Comparison of the Subject Elections and the Scholastic Records of Athletes and Non-Athletes." Jones has attempted to determine the extent of truth in the accusation that high school athletes tend to elect less difficult subjects and lighter subject loads than the non-athletes, and also that they receive lower scholastic grades in the subjects selected.

The study covers the athletes of only one institution for a period of two years, involving 100 athletes and 448 non-athletes.

Some of the outcomes of the study follow:

1. Practically the same subjects were elected by both groups.
2. The athletes elected practically the same subject load for each semester over the two year period of the study.
3. The average grade of all subjects for both groups was the same.
4. The highest average grades of all subjects for the athletes competing in individual sports are in the following order: golf, tennis, track, wrestling, basketball, and football.
5. It was found that boys who failed subjects and are not in athletics are less likely to repeat work that has been failed than the boys in athletics, perhaps due to the desire to regain eligibility.

Books—General Athletics

Berry, Elmer. *Philosophy of Athletics.* New York: A. S. Barnes and Company, 1927. Pp. 214, illustrated—photographs, charts and diagrams. $2.

The educational basis of athletics from the viewpoint of psychology, social values, ethical values, emotional values, and character building values. The latter part of the book is on the psychology of coaching, stressing the function of the coach as a teacher.

Bickley, Graham. *Handbook of Athletics for Coaches and Players.* New York: A. S. Barnes and Company, 1929. Pp. 151, illustrated—diagrams. $1.80.

The four major sports described are baseball, track, basketball, and football. It is a guide for the high school coach and player.

Bowen, Wilbur P. *The Conduct of Physical Activities.* New York; A. S. Barnes and Company, 1927. Pp. 173, illustrated—charts, diagrams, and photographs. $2.

The emphasis of the book is placed on mass activities, with sections devoted to the organization and conduct of contests and meets, *i.e.*, round-robin tournaments, etc. It is for use in the elementary and the high school.

Brammell, P. Roy. *Intramural and Interscholastic Athletics.* Bulletin 1932, No. 17, of the National Survey of Secondary Education, Monograph No. 27, Washington, D. C.: U. S. Government Printing Office, 1933. Pp. 144. Ten cents.

This is an authoritative federal survey of what the high school athletic picture really looks like from a national look-out tower. Of this study Scholastic Coach said (Sept., 1933, issue): "You can thank your Government for a most timely and valuable contribution to high school athletics; for an illumination that permits you to examine the national high school athletic picture in a flood of light to which it has never before been exposed." The study ranks, in the order of their degree of troublesomeness, twenty-eight problems which high schools find more or less troublesome, ranging from "salary of the coach as compared to that of other staff members" to "Inducements to high school athletes offered by private individuals, alumni, business men, or other persons interested in certain higher institutions."

Campbell, William G. and Reed, Ralph K. *Coaching High School Athletics.* Los Angeles: C. C. Crawford, University of Southern California, 1933. Pp. 207, illustrated. $2.

A book on coaching and administration of the athletic program, non-technical in nature and easy to read, attempting to solve the problems met by the coach. Chapter headings include "Arousing and Maintaining Interest in Athletics," "How to Organize the Department," "How to Finance the Department," "How to Develop Good Sportsmanship," "How to Develop Team Spirit," "How to Lessen the Problem of Ineligibility," "The General Technique of Teaching Games; of Teaching Recreational Games; of Coaching Competitive Sports."

Griffith, Coleman R. *Psychology and Athletics.* New York: Charles Scribner's Sons, 1928. Pp. 281. $2.

An excellent psychological approach to the problem of athletics. Containing a psychological analysis of the principle sports, and such problems as play, work, fatigue and reaction time on activity.

Griffith, Coleman R. *The Psychology of Coaching.* New York: Charles Scribner's Sons, 1926. Pp. 213, illustrated—diagrams. $2.

A companion volume to *Psychology and Athletics.* The formulation of psychological principles for use by the coach, resulting from experimental studies by the author.

Hammett, Charles E. *Major Sport Fundamentals.* New York: Charles Scribner's Sons, 1927. Pp. 220, illustrations—photographs, and diagrams. $2.

Suggestions for developing successful teams in football, basketball, track and baseball accumulated by the writer as a result of more than thirty years of experience.

Hillas, Marjorie and Knighton, Marian. *An Athletic Program for High School and College Women.* New York: A. S. Barnes and Company, 1929. Pp. 90, illustrated—photographs, diagrams and charts. $2.

Contains an excellent athletic program for girls, with a suggested bibliography and achievement tests in each of the following sports—soccer, hockey, basketball, baseball, speedball and field ball.

Lindwall, Robert Edward. *Intramural Activities, Their Organization and Administration in the Junior and Senior High School.* Manitowoc, Wisconsin: Published by the author, 1933. Pp. 88. $1.

A modern intramural set-up for high schools, written by a high school man. A feature of the book is the program set-up in various high schools. The vital Chapter IV takes up every detail of the organiza-

tion and administration of a high school intramural program; gives problems and their solutions; discusses eligibility rules, awards, faculty participation, schedule making, financing the program, interest-getting devices, and a dozen other cogs in the intramural wheel.

Mitchell, Elmer D. *Intramural Athletics.* New York: A. S. Barnes and Company, 1929. Pp. 191 illustrated—photographs and diagrams. $2.

A book by the "father" of intramural athletics, based on "Sports for all and sport for sport's sake." A valuable guide containing the complete information for a program of intramural activities, involving such items as organization, scoring plans, rules and regulations, awards and administrative problems.

Nash, Jay B. *The Organization and Administration of Playgrounds and Recreation.* New York: A. S. Barnes and Company, 1928. Pp. 547, illustrated—photographs, diagrams and charts. $3.

Part of this excellent text is devoted to the management of leagues and tournaments, and to the equipment and supplies required for playgrounds and athletic fields. Numerous drawings show how to lay out the play areas.

National Recreation Association. *Recreative Athletics.* New York: A. S. Barnes and Company, 1930. Pp. 200. $1.

A paper covered book 4½ x 9⅝, that fits into the pocket. An excellent guide containing suggestions for programs of recreative athletics, games and sports, and for conducting the program.

Post, Julia H. and Shirley. *Selected Recreational Sports.* New York: A. S. Barnes and Company, 1933. Pp. 132, illustrated photographs and diagrams. $2.

Contains the techniques of recreational activities for girls and women (omission of so-called "major" sports) as well as instructions for laying out the playing areas and care of equipment.

University of Michigan, Staff of the Department of Physical Education for Women. *Physical Education Activities.* Philadelphia: Lea and Febiger, 1928. Pp. 322, illustrated—diagrams. $3.50.

Valuable suggestions for a complete program of physical education activities for high school girls. Part of the text is devoted to individual sport and team games, such as swimming, canoeing, tennis, golf, archery, and special day activities.

Wayman, Agnes R. *Education Through Physical Education.* Philadelphia: Lea and Febiger, 1934. Pp. 378, illustrated—charts and diagrams. $4.

A book written for girls and women, presenting physical education from a woman's viewpoint. A summarization is made of the case for and against interschool competition. The relationship of the athletic association to the physical education department is shown, as well as the organization and set-up of individual events, field days, special days and track meets.

Williams, Jesse F. *The Organization and Administration of Physical Education.* New York: Macmillen Company, 1923. Pp. 325, illustrated — diagrams, charts, and graphs. $2.

A text devoted partly to athletics from the administration standpoint, "pros and cons" of interscholastic athletics for boys and girls; management of sports, games and contests; schedule making and layout of athletic fields.

Williams, Jesse F. and Hughes, William L. *Athletics in Education.* Philadelphia: W. B. Saunders Company, 1931. Pp. 414, illustrated, charts, diagrams and photographs. $3.

The outstanding feature of the book is a bibliography of approximately 100 pages. The factor of athletics in relation to education is discussed, as well as practical and concrete suggestions for the conduct of athletics.

Williams, Jesse F. and Morrison, Whitelaw R. *A Text Book of Physical Education.* Philadelphia: W. B. Saunders Company, 1931. Pp. 343, illustrated—charts, diagrams and photographs. $2.75.

The fundamental skills of walking, running, jumping, throwing, etc. are discussed as well as instructive hints on form and training. One chapter of the book has something new, as far as textbooks go, being devoted to instructing the individual in "how to read the sports page."

Williams, Jesse F. and Nixon, Eugene W. *The Athlete in the Making.* Philadelphia: W. B. Saunders Company, 1932. Pp. 258, illustrated—photographs. $2.50.

A presentation of scientific data to specific situations in physical activity. An excellent text that first explains the underlying scientific facts of all athletic skills, discusses training and conditioning, and finally applies them to various athletic activities.

Wingate Memorial Lectures—Public School Athletic League. New York: Wingate Memorial Foundation. Illustrated. Each $2.

Intimate Talks by Great Coaches, 1929-30, pp. 578.

School Athletics in Modern Education, 1930-31, pp. 689.

Aims and Methods in School Athletics, 1931-32, pp. 481.

The above three books are outstanding in the field of scholastic athletics. They contain the talks presented by coaches and other authorities in the field of physical education to a group of coaches of scholastic teams of the metropolitan New York area.

Women's Division, National Amateur Athletic Federation—*Women and Athletics.* New York: A. S. Barnes & Co., 1930. Pp. 95. 75 cents.

This paper-bound book is in five divisions, following an introduction by Ethel Perrin: 1) General; 2) Competition; 3) Organization; 4) Play Days; 5) Olympics; 6) Resolutions. Each division contains a number of statements and articles by leaders in physical education. Their attitudes toward interschool competition for girls, girls in Olympics and similar questions reflecting the difference of opinion between school leaders and big-time sports promoters, are emphatically stated.

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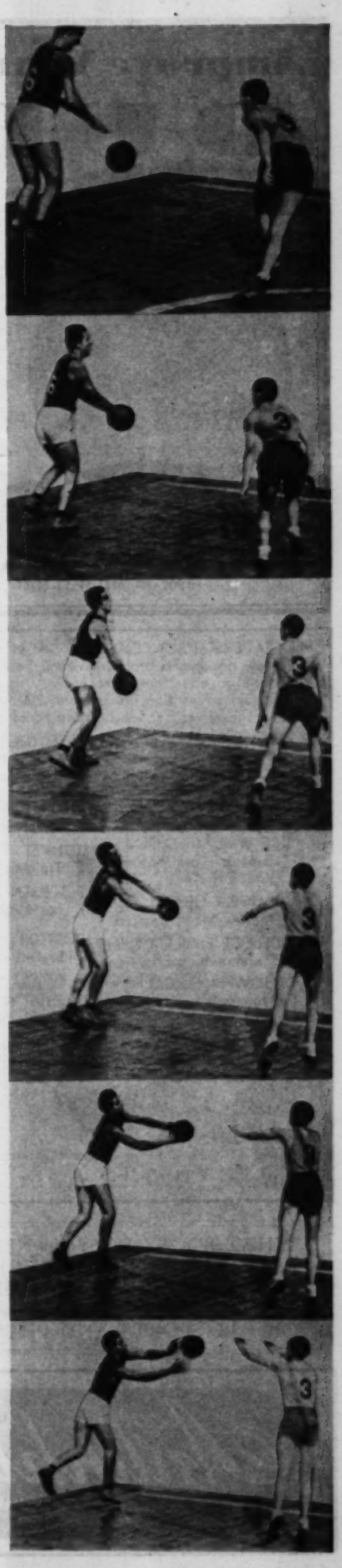
Dribbler forced into corner of the court gains clearance for banked underhand shot by drawing away from the defensive player as far as necessary and releasing the ball well inside. This shot is of no value unless it can be banked. If dribbler goes too deep into the corner on regulation floor where bankboards are two feet inside the court, the shot cannot be used. With practice, players can become fairly accurate with this emergency shot.